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METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS

VOL 98 No 1 ONE SHILLING

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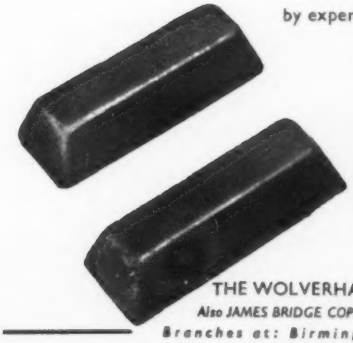

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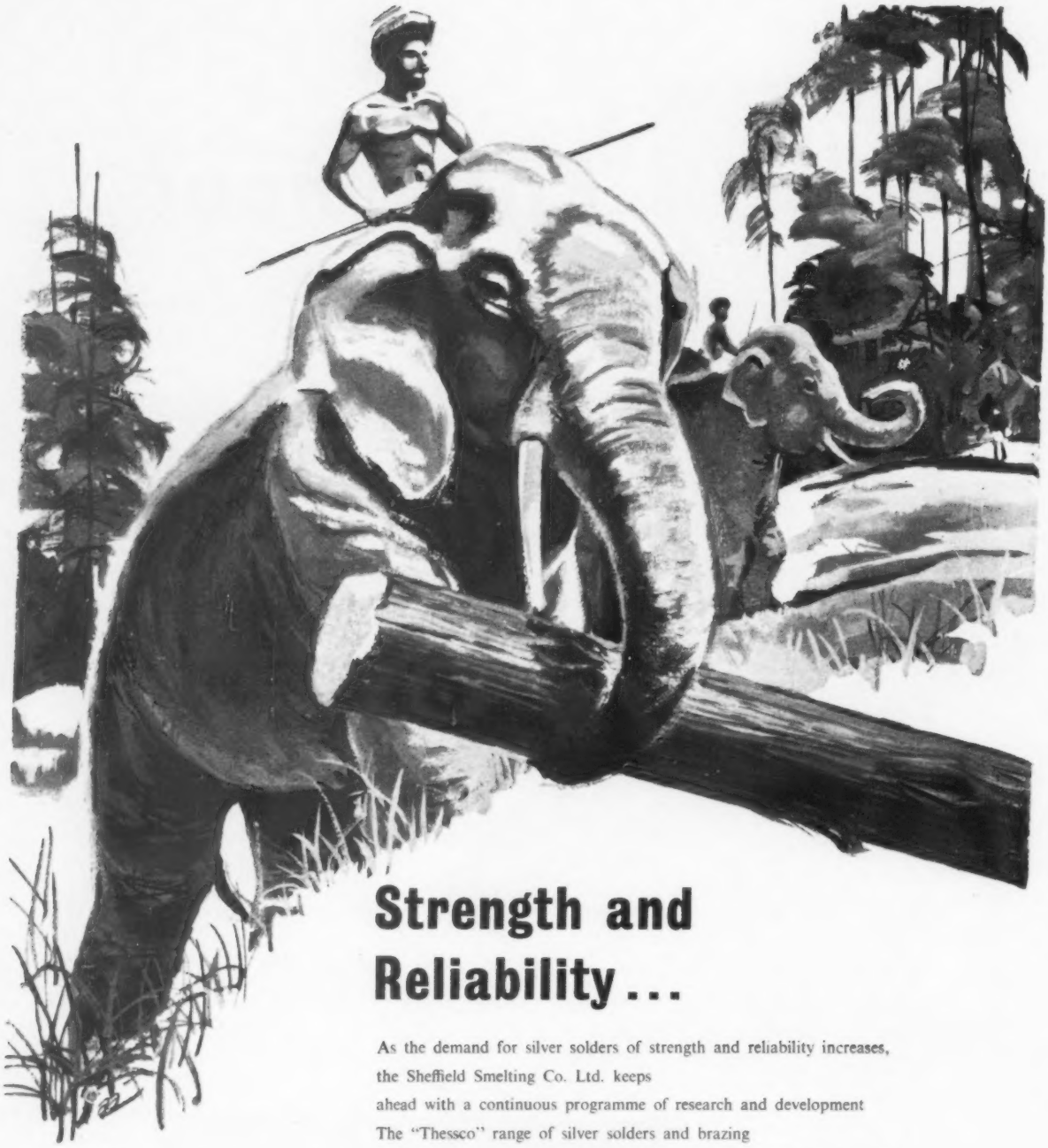

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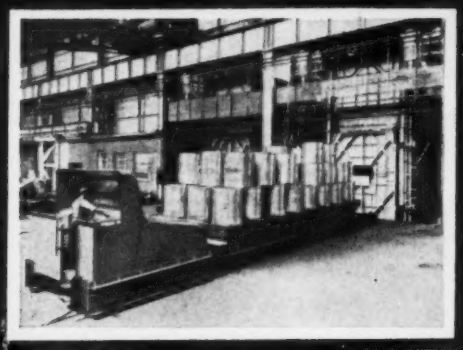

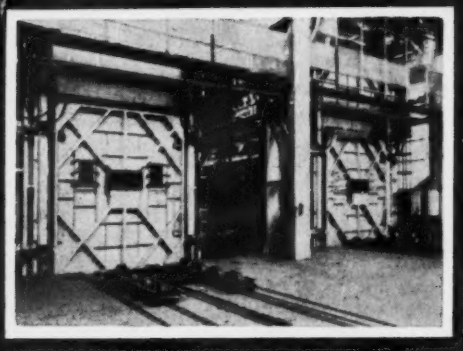

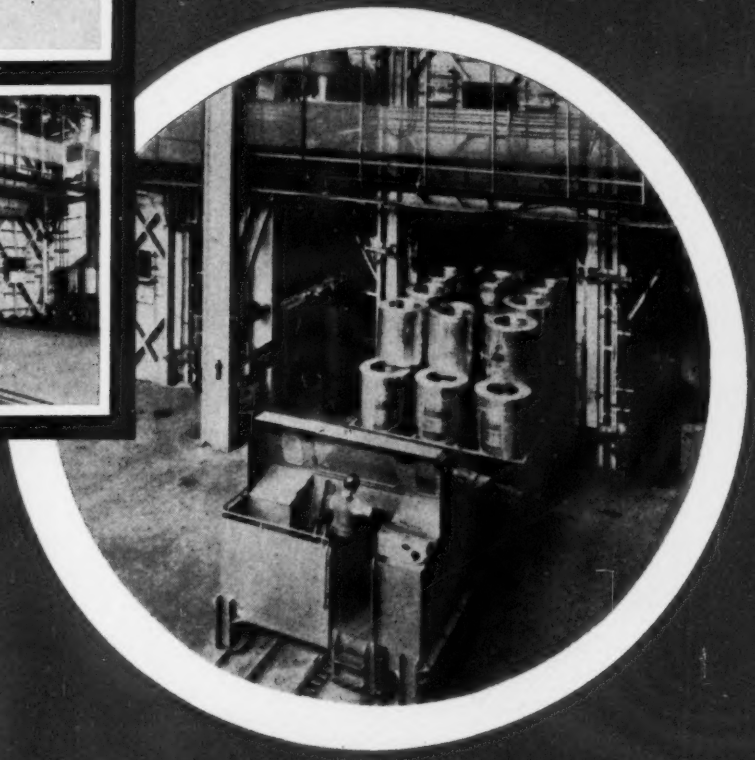

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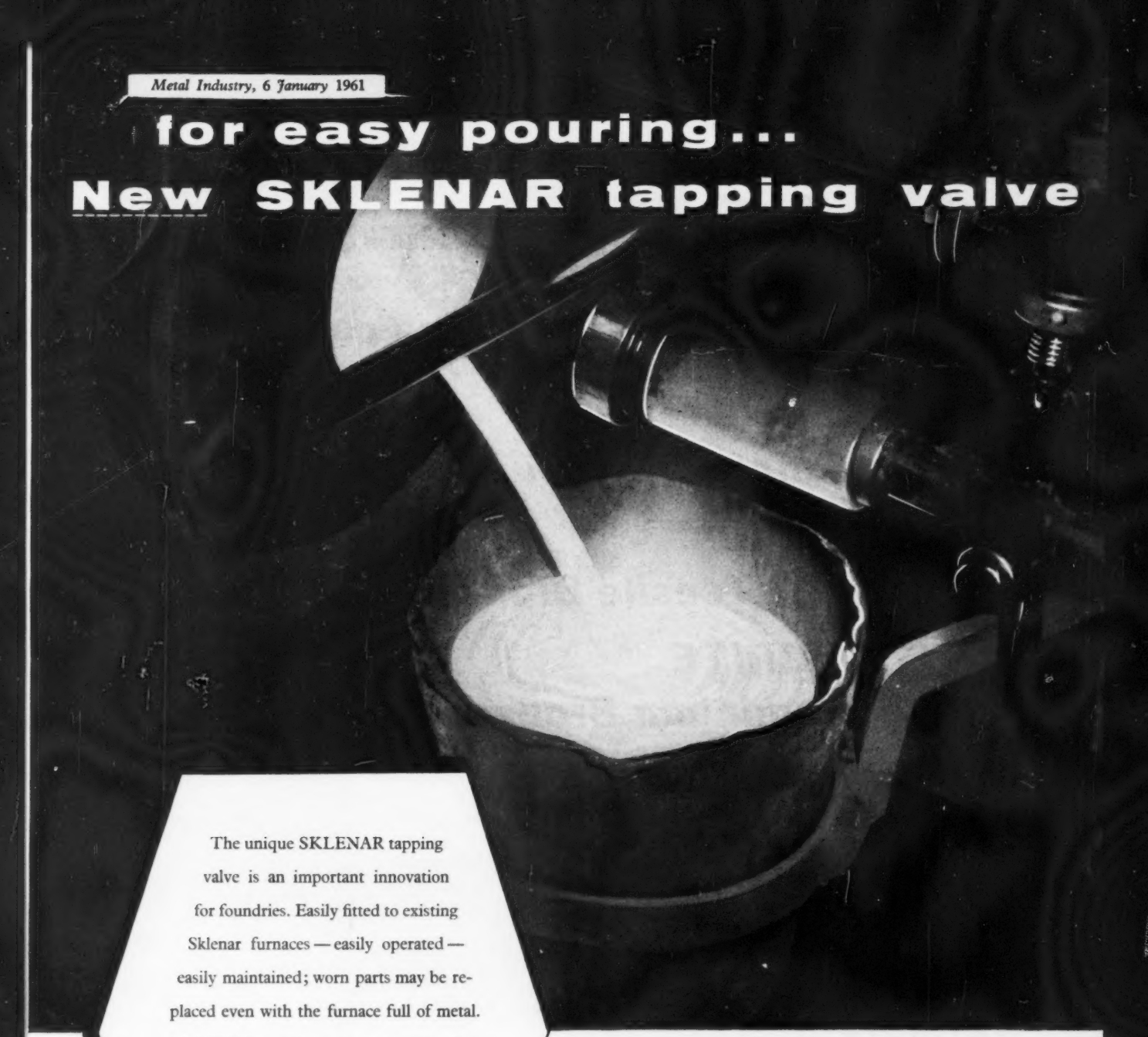

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METAL INDUSTRY

VOLUME 98 NUMBER 1 6 JANUARY 1961

Metals in China

WITHIN five years it is anticipated that Communist China will become a medium world producer of non-ferrous base metals. According to K. P. Wang, of the American Bureau of Mines, there exist reserves of copper, lead and zinc of 3 to 6 million tons each, and primary output for all three metals is expected to surpass 100,000 metric tons per annum by 1962, and 150,000 tons by 1965. For the metals in question, existing mines and smelters, which are fairly up-to-date, range in capacity from 5,000 to 20,000 tons. New non-ferrous base metal centres being developed include the Chung-t'iao-shan copper mine, the Sian area copper-lead-zinc mine and smelter in Shensi, Shao-kuan copper-lead-zinc mine and smelter in Kwangtung, the T'ao-lin lead-zinc mine in Hunan, the Sidin lead-zinc mine in Kwangsi, the Hui-li zinc project in Sikang, and an unspecified location in Lianoning.

In recent years production of tin has been about 67 per cent more than in the pre-Communist peak year. Reserves can support an annual output of 30,000 tons indefinitely. A yearly surplus of approximately 20,000 metric tons of refined tin will exist for some years to come, part of which will continue to be absorbed by the Soviet Union and its European satellites. Much progress has been made in expanding facilities, streamlining operations and making better-grade products.

Still the largest in the world in terms of output and reserves, the Chinese antimony industry is not producing as much as in the past for lack of world markets. Mercury deposits are widespread and China's world position in this metal should improve in the future. Output of bismuth, already large by world standards, is capable of increase should the export market become greater. Refined bismuth is made at several refineries, but a large part of the bismuth is exported as concentrates.

A small integrated aluminium industry is already in existence, and is in process of rapid expansion. Annual output of primary aluminium is expected to exceed 100,000 metric tons by 1962, and 150,000 tons by 1965. At present, rolling capacity appears to be larger than primary output. Although existing demand greatly exceeds production, necessitating large imports of aluminium ingots, the raw material position is strong both in resources and distribution. Since, however, much of the ore is not treatable by the conventional Bayer process, other methods of pre-treatment are being investigated, with fair success. The rate of development of the aluminium industry will depend primarily on the construction of the necessary facilities, but it is anticipated that Communist China will emerge as a medium-sized world producer within five years.

Although magnesite resources in Manchuria are extensive and of high purity, little information is available concerning magnesium production, and apparently the country is somewhat deficient in magnesium at present. Neither is much known about the resources and production of radioactive and related minerals. Some selenium, cadmium, germanium and rare-earth metals have been produced, mostly on an experimental scale.

Notwithstanding the fact that the accuracy of Communist China's industrial statistics may be open to question, there can be no doubt about their order of magnitude. Within a decade, the country has been transformed from an economy primarily agricultural to one bristling with industrial possibilities. Regardless of the current stage of industrial development, the many capital construction projects being brought into production and the additional projects being initiated show that China is well on the road to becoming a world power, though the living standards of its people will remain below European levels for many years to come.

Out of the MELTING POT

Not Straightforward WHAT a pity it is that there are still no really promising large-scale applications in sight for plastics containing additions of metal powders or, for that matter, metal fibres. Just one or two such applications would certainly stimulate research on the properties of such combinations. Judging on the basis of first principles and the few known examples, it is easy to visualize the addition of metal powder resulting in an improvement in mechanical strength and heat-resistance and, after sufficient has been added, the appearance of electrical conductivity. The indications of what little research has been done, however, are that the effects may not all be quite so obvious. Thus there have been indications that mixtures of certain polymers with very finely divided metal powders may develop semi-conducting properties. Another investigation has now shown that the effect of electrolytic iron powder on the compressive strength of plastics is quite different for different plastics. For a polyamide resin, for example, the addition of the first 5 per cent of iron powder produced an increase in strength of about 20 per cent, after which there was no further change up to an iron content of 100 per cent. In the case of polyethylene (with a 50-75 per cent content of crystalline phase), additions of iron powder up to over 60 per cent had hardly any effect, after which the strength started to increase rapidly and reached a maximum at an iron powder content of 85-90 per cent. Finally, in the case of a phenol-formaldehyde resol-type resin, the strength increased steadily with iron content, being double that of the unfilled resin at 30 per cent iron, six times at 50 per cent iron, and reaching the maximum sevenfold increase in strength in the presence of 75-80 per cent iron powder, after which there was a slight drop. The effect of iron powder additions on the behaviour of the above plastics at elevated temperatures (deformation on heating under a compressive load) was also quite different for the different materials.

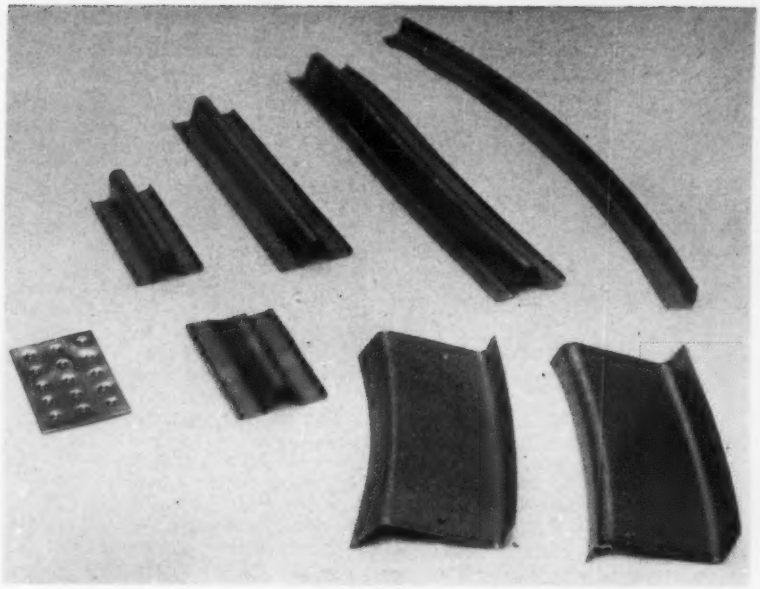
Isolated Details IT is probably too much to expect to find detailed results of comparative tests on the life of spot welding electrodes in relation to the composition of the electrode materials, the method of manufacture and the heat-treatment. In the absence of such information, occasional isolated data may perhaps be worth noting as and when they are encountered. Typical data of this kind have recently been briefly reported from a Russian motor car works. The interest attaching to these results is added to by the fact that the electrodes were made by cold pressing instead of the more usual machining from the solid rod, and that the compositions of the copper-base alloys are given. These were Br.Kh-07 alloy with chromium contents of 0·44-0·48 and 0·69-0·72 per cent, and MTs-4 alloy with 0·67-0·72 per cent chromium, 0·2 per cent aluminium and 0·19 per cent magnesium. Manufacture from the 16 mm. diameter, 33 mm. long blanks included quenching from 1,000°C., cold pressing, tempering at 450°C. for 5 hr., pickling and deburring. The cold pressing, in an 80-ton mechanical press, comprised three stages: the forming of the working end of the electrode, the forming of the hollow in the stem which was done by backward extrusion, and the forming of the outer taper. In the case of the MTs-4 alloy, the taper was formed in two operations because of the lower ductility of the alloy. When used under relatively easy conditions to spot weld a motor body part made of 1·2 mm. thick cold rolled steel (electrode loading, 150 kg.; welding speed, 60 spots/min.), electrodes made of the Br.Kh-07 alloy gave the best performance with 10,607-12,271 welds/mm. wear of the electrode (regardless of the difference in the chromium content of the two alloys of this type). Electrodes of MTs-4 were less satisfactory, with 6,481-11,267 welds/mm. wear. Under much more arduous conditions, in the spot welding of commercial vehicle chassis members having a thickness of 6·2 mm. (electrode loading, 1,100-1,200 kg.; welding current, 23,000-24,000 amp.), however, there was practically no difference between electrodes of Br.Kh-07 and MTs-4 on the basis of the number of members welded before the electrodes had finally to be replaced (63-79 members). Electrodes of another copper alloy (MTs-5B—0·31 per cent chromium and 0·29 per cent cadmium), which were also tried for this particular job, gave a rather better performance, welding 96-100 members before having to be replaced.

Just a Detail ONE of those minor details, the multitude of which renders the phenomenon of friction and wear so complicated, is the fact that with two sliding surfaces of the same material but of different surface area, the one with the larger area suffers more wear than that with the smaller. This has been explained on the basis that the larger surface will contain a larger number of surface defects, from which wear originates, though the number of these defects or weak spots per unit area of the two surfaces is the same. This view has been shown to be unlikely by tests using models of surfaces with weak spots. These models were made of plaster, with the defects constituted by small cast-in steel balls, the concentrations of steel balls per unit area of the two test surfaces being equal. Wear tests with two such model surfaces, one larger than the other, showed that the wear (as measured by the number of steel balls lost from a surface) was greater for the smaller surface. This difference diminished with the difference in area of the two surfaces; two surfaces of equal area suffered equal amounts of wear. Further experiments with specimens of rock salt, with the surfaces treated in various ways to produce widely different concentrations of surface defects, showed that such defects were not a predominant factor, and that the main cause was to be sought in the dynamic phenomena accompanying sliding and wear. Evidence obtained from metal surfaces suggested that the reduced wear of the smaller surface is due to the formation of a more strongly cold worked surface layer. While this is true in the case of low sliding speeds, and consequently low surface temperatures, the state of affairs alters at higher speeds, at which the effect of temperature becomes decisive, a point of inversion ultimately being reached at which wear of the smaller surface becomes greater than that of the larger surface.

Skimmer

Forming Techniques for Titanium Alloys

By J. PODY, B.Sc.Eng.
(*Hawker Aircraft Ltd.*)



Components produced from 318A sheet on hand bending blocks or by brake pressing

A Symposium on "Titanium Production Methods in the Aircraft Industry," was held last year at the Waunarlwydd works of Imperial Chemical Industries Limited, and among the Papers presented was the one published below. It describes an investigation into forming techniques for two I.C.I. alloys, 318A and Ex. 011. carried out at Hawker Aircraft Limited.

INVESTIGATION into the use of titanium for aircraft parts began at Hawker Aircraft Limited in 1954, using commercially pure titanium sheet from both American and British sources. By 1957, the investigation was directed towards using the promising high strength aluminium - vanadium alloy then being developed. In 1958, a Ministry of Aviation contract was awarded to develop forming techniques for a 6 per cent aluminium - 4 per cent vanadium-titanium alloy. Later development work by Imperial Chemical Industries Limited (Metals Division) produced a heat-treatable alloy, known as Ex. 011, containing 15 per cent molybdenum. The work programme was extended to include this material in the investigation. Work is still in progress, and consequently many of the conclusions remain to be finalized.

I.C.I. 318A and Ex. 011 Alloys

A brief summary of typical test results will illustrate the need for special forming techniques. The results given in Table I were obtained on a recent 18 S.W.G. sheet of 318A alloy.

To date some variation of properties has been found on different sheet casts, but recent developments will lead to more constant heat-treatment requirements.

Typical results obtained on 18 S.W.G. Ex. 011 sheet are given in Table II.

Consideration of the range of potential properties has led to the selection of 505°C. as a convenient treatment temperature giving acceptable strength and ductility; as this is the temperature of the light alloy solution treatment salt baths, it is also extremely convenient from the production aspect.

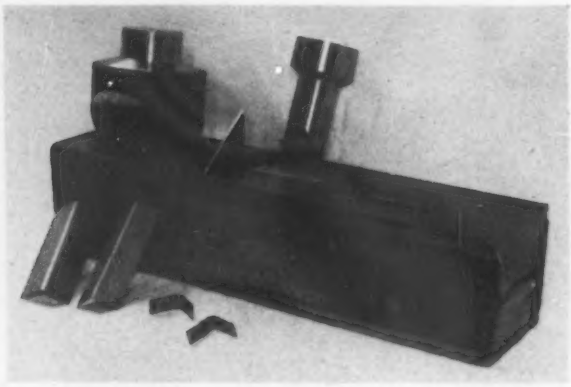
With regard to bend testing, which may be used to give an indication of formability, various methods have been investigated. The results given in Table II were obtained by impressing a $\frac{1}{2}$ in. strip of material into a lead block with a punch of known radius, the figures quoted being the minimum radii obtainable prior to cracking of the test strip. The punches used for both $\frac{1}{2}$ in. and 4 in. wide strips are

TABLE I—PHYSICAL PROPERTIES OF 318A ALLOY

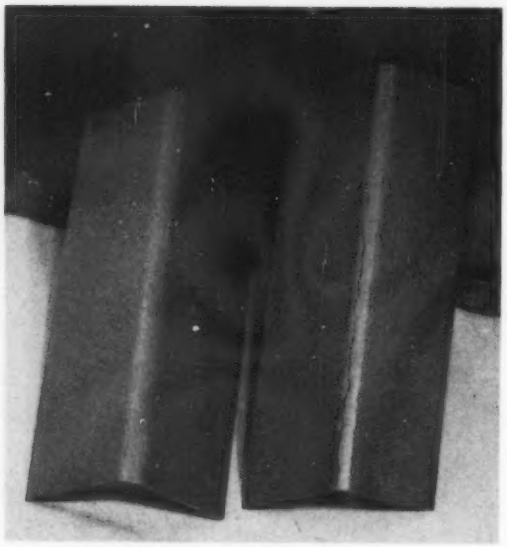
0·1 per cent proof stress tons/in²	Longitudinal	69·9
	Transverse	58·7
Ultimate tensile stress tons/in²	Longitudinal	74·2
	Transverse	68·7
Elongation per cent on 2 in	Longitudinal	8
	Transverse	9½
Bend test	Longitudinal	3·3*t*
	Transverse	3·9*t*

TABLE II—EFFECT OF HEAT-TREATMENT ON EX. 011 ALLOY SHEET

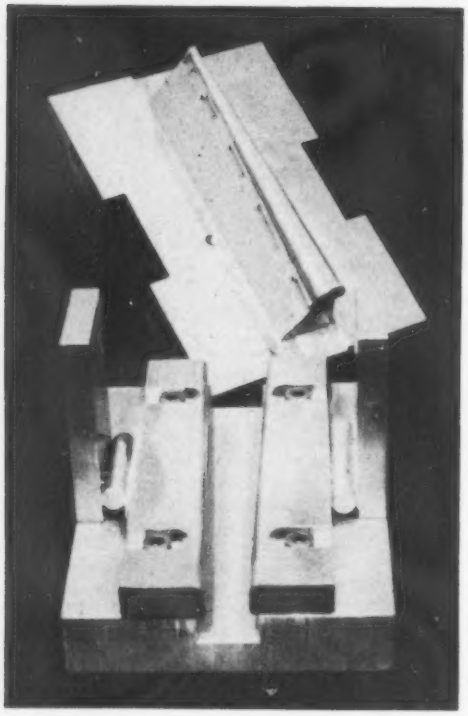
Condition	0·1 per cent Proof Stress tons/in²		Ultimate Tensile Stress tons/in²		Elongation per cent on 2 in		Bend Test
	Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse	
Solution Treated	35·9	37·3	48·8	49·2	23	24	1*t*
Precipitation Treatment							
16 hours at 475°C.	88·1	—	89·0	—	4·5	—	—
500°C.	66·0	—	76·1	—	6	—	—
505°C.	67·3	—	78·2	—	6	—	—
525°C.	63·1	—	73·5	—	7	—	—
550°C.	56·6	—	65·7	—	9	—	—



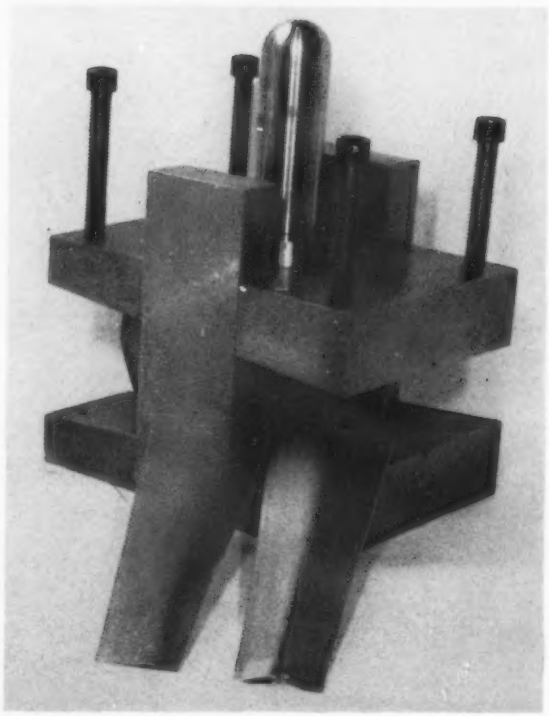
Above: Fig. 1—Punches used in bend tests, ½ in. and 4 in. strips



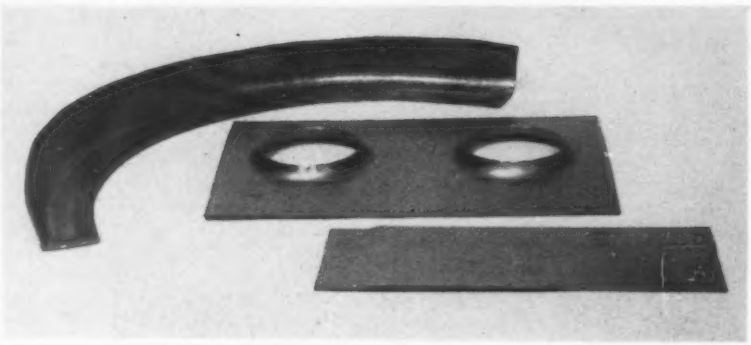
Right: Fig. 2—Bend test specimens showing parallel fracture lines



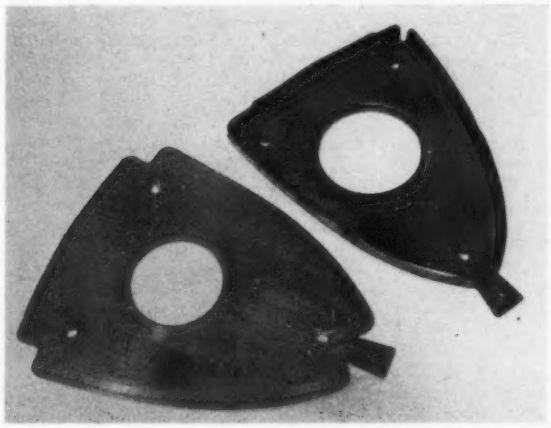
Above: Fig. 3—Bend test for up to nine ½ in. test strips

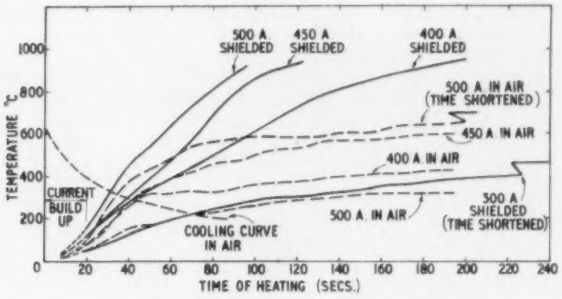


Above right: Fig. 4—Free cone bend test



Right: Fig. 5—Components cold formed from 318A sheet





Left: Fig. 6—Hot forming by furnace heating and power pressing on cold tool: typical blank and finished component

Above: Fig. 7—Resistance heating curves for 318A alloy

shown in Fig. 1. A gauge is used to indicate when a 90° bend has been obtained. Both test pieces shown in Fig. 2 exhibit cracks, indicating that the lead exerts a stretching action upon the material resulting in parallel fracture lines.

A feature of this method of testing is that the lead exerts an under-pressure on the strip, so tending to prevent "peaking" of the material as a result of the stiffness of the alloy. If the material peaks while being bent, the test strip no longer maintains a contact around the punch and a radius is formed which is smaller than the punch radius; consequently the material may fracture. Use of the lead (or rubber) block method is indicated where the forming method incorporates some form of under-pressure.

In the bend test illustrated in Fig. 3, up to nine $\frac{1}{2}$ in. test strips may be bent in one operation, with the radius of bend decreasing by $\frac{1}{2}t$ for each strip. The radius of the strip at which cracking first occurs indicates material formability. Again, due to the material stiffness, "peaking" and premature fracture may occur. This test should be used where no under-pressure is incorporated in the forming method.

A free cone bend test (Fig. 4) has been devised for light alloys to eliminate tool variables which would affect the bend test value. By this method, the stiffness of the material is utilized to create a bend, the radius of which is a function of the stiffness. By tapering the test piece, the stiffness is varied and a decreasing bend radius formed. This test is applicable to commercially pure titanium sheet and Ex. 011, but is unsatisfactory for 318A as the notch sensitivity tends to cause continuation of a crack once started in the material.

Cold Forming of 318A

On production components, a bend radius of $5t$ is the minimum that can be produced consistently cold without any cracking. Components with bends less than this must be hot-formed.

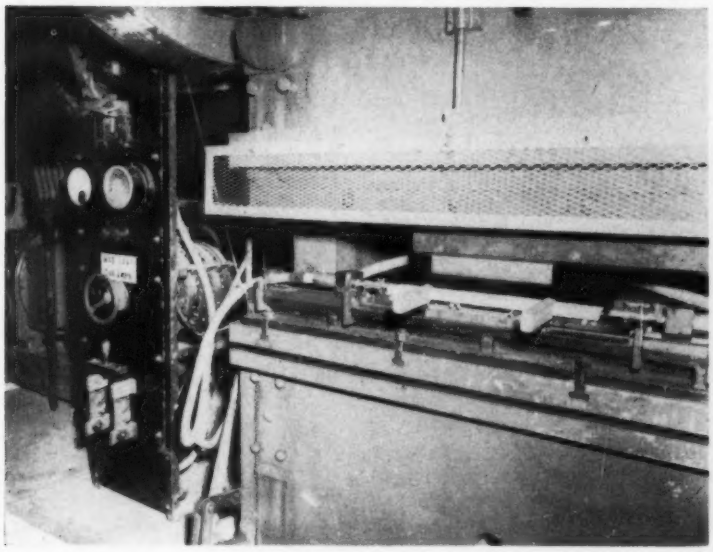
The components shown in the illustration at the head of this article, representing forms obtained from 318A sheet, were produced on hand bending blocks or by brake pressing.

As expected in the transition from experimentally produced sheet, some properties, notably bend radius, have not been maintained, but Fig. 5 shows that some cold forming is still possible. The stringer section has a $4t$ bend which fractured and a satisfactory $5t$ bend, formed on a brake press. The flanged lightening holes are $1\frac{1}{2}$ in. diam × 0·22 in. flange depth, produced on a fly or power press, and the joggle sample in 18 S.W.G. sheet has a $\frac{1}{4}$ in. runout by 0·5 in. deep.

Hot Forming of 318A

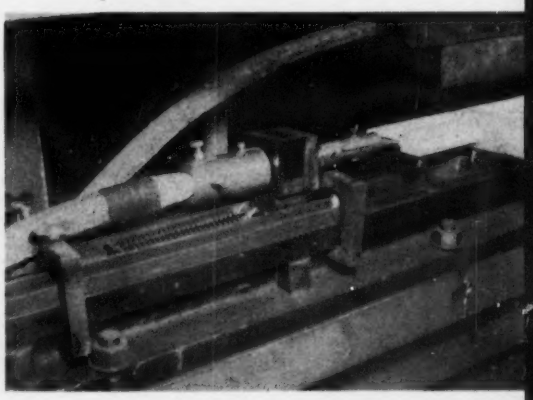
Of the numerous methods for hot forming, two have been selected—furnace heating of the blank followed by power pressing on a cold tool, and electric resistance heating of the blank, also with cold tools.

In the first method, an electric muffle furnace is sited close to a power press and the blank heated to a temperature of around 850°C. With this arrangement, the temperature of the blank does not fall excessively during the transfer from furnace to press. Obviously, heat loss is dependent upon many factors, time, ambient temperature, mass, and surface area of blank.



Left: Fig. 8—General view of resistance heating set-up

Below: Fig. 9—Close-up showing electrode clamp, tension springs and asbestos shield



For this reason, as the gauge of the blank is decreased, the furnace temperature must be increased. However, owing to metallurgical changes in the material, it is inadvisable to exceed about 900°C. and, consequently, for sheets thinner than 22 S.W.G. some form of heat-retaining sandwich is required.

From the furnace, the blank is transferred rapidly to the press and formed. The tool is not heated, as the action of the power press is so rapid that the blank retains a suitable temperature during the forming cycle. To minimize heat loss from the blank during transfer from furnace to press, the tongs are asbestos covered, the blank is gripped on a handling lug and is located on spring-loaded pins clear of the bottom die. Any local chilling by the pins themselves is of little account, as the tooling holes are drilled in the centre of the blank where no forming is required, and are elongated to cater for contraction of the blank on cooling. A typical blank and the finished component are illustrated in Fig. 6.

Electric resistance heating is satisfactory on blanks of constant section, and stringer sections have been produced by this method on a brake press. Due to the high forming temperatures required, the problem of heat loss from the blank becomes critical. Tests on heat loss from a strip, both unshielded and shielded, reveal the necessity for an effective heat retainer.

On a 2 in × 2 ft × 18 S.W.G. strip, 500 amp. gave a maximum temperature of only 700°C. When the strip was shielded by an asbestos glove, 500 amp. raised the temperature to 950°C. in 1½ min., while at 400 amp. this temperature was reached in 3½ min. (Fig. 7).

A general view of the resistance heating set-up is illustrated in Fig. 8, while Fig. 9 shows the electrode clamp and the tension springs used to eliminate droop of the hot strip. The asbestos shield may be seen covering the titanium alloy strip.

When brake pressing stringer sections by this method, it was found that a scrap allowance of 5 in. on either end was required.

(To be concluded)

Electrical Equipment in Non-Ferrous Metal Production

IN the field of heavy electrical equipment, the non-ferrous metals industries provide a large and expanding market. Rolling mills, ore process plants, welding equipment and control installations are included in the plants which have incorporated devices manufactured by The English Electric Co. Ltd., and some of these applications are outlined in the following summary.

Rectifiers

A number of important orders were received during 1960 for mercury-arc and silicon rectifier equipment for industrial, electrochemical and traction duties, and for mercury-arc converters, operating as rectifiers or inverters, for supplies to variable-voltage motor drives in rolling mill and mine winder applications.

In the electrochemical field, notable orders included a 45,000 kW mercury-arc rectifier installation for the production of aluminium in India. Rectifier equipments totalling 19,600 kW, embodying silicon rectifiers, were also ordered for electrolytic refining of copper in Rhodesia.

The high efficiency of the mercury-arc converter is being utilized for the supplies to large reversing drives. Two 4,800 kW equipments for winding duties in South African gold mines are believed to be the largest equipments of their type so far considered for this important duty. Several large mercury-arc converter equipments for rolling mill main drives, mainly for hot reversing applications, were ordered during the year.

Power Drives

Amongst the orders received for drives for the metal industries is a contract from Ghana for electrical drives for a hot reversing mill and two cold mills in an aluminium rolling mill at Tema, near Accra, for Alcan Industries. The order was placed through W. H. A. Robertson, of Bedford, following joint discussions with Aluminium Laboratories in Montreal.

Other export orders include drives for a breakdown and structural mill, a cold reversing strip mill and a Sendzimir mill for Australia, a cut up line for South Africa, and a coil rewind line for Belgium.

A large number of orders for the home market include drives for universal beam mills for both Appleby Frodingham and South Durham Steel and Iron; a universal slabbing mill and continuous billet mill for Richard Thomas and Baldwins; and a hot reversing mill and a reversing cold strip mill for James Booth, both of which are for rolling aluminium.

Industrial Control Equipment

During the year, a wide range of static electronic control equipments has been developed, known as the English Electric "Unistat" range. It includes a variety of A.C. and D.C. variable-speed motor control schemes of the saturable reactor type and a full range of magnetic logic elements and contactless sensing devices. These equipments, together with the existing range of magnetic amplifiers, provide a comprehensive selection of static units for inclusion in the many industrial process control schemes with which the company is associated.

A number of the latest developments in the use of static techniques have been incorporated into many of the comprehensive control schemes built for the metal industries.

Welding Equipment

The most important activity of the current year has been the introduction of the English Electric LWAD range of welding equipment from which it is possible to get both A.C. and D.C. from one power source. This range is now available in three sizes, namely 300, 450 and 600 amp., and is the first of its type to be manufactured in the U.K. It is suitable for fabrication shops undertaking a wide variety of work, maintenance departments and, in fact, any shop where the use of D.C. is required for welding. This equipment has proved very popular in the export field because it is suitable for operating outdoors in all climates and has no moving parts.

Demand for the company's single and multi-operator arc welding transformers has continued at a high level, and substantial orders have been received from both home and overseas markets. The newly introduced double-operator welding equipment, known as the LWC.2/300, has also sold well.

A development that has aroused interest in home and overseas markets is the English Electric welding meter for use in welding research and production. This meter comprises an ammeter, a voltmeter and a watthour meter and enables the electrical conditions of an A.C. welding arc to be observed.

The composite multi-operator welding equipment continues to find favour in shipyards and industry at home and overseas and recent important installations have included shipyards in Portugal, South Africa, India, Hong Kong, Singapore, Peru, as well as numerous yards in the U.K.

Powder Metal Parts

CASE histories of a variety of small, complex powder metallurgy parts, illustrating the role of this process in miniaturization, are outlined in *Powder Metallurgy Quarterly*. The applications described include stainless nozzles for electric steam irons; a high density, file hard, steel flint guide block for a cigarette lighter; a brass cam follower tip made to ±0·001 in. tolerance; small stainless bushings that operate at 1,400°F. in an automotive heat control assembly; a sprocket pinion with 35,000 lb/in² tensile, and 100 in.-lb. tooth torque; and a worm gear hobbed from a powder metallurgy blank. A copy is available free from the Metal Powder Industries Federation, 60 E. 42nd Street, New York 17, N.Y.

Finishing Supplement

Vitreous-Enamelling Aluminium

VITREOUS - ENAMELLED aluminium has comparatively recently come into commercial production on a large scale in Great Britain after successful development in the U.S.A. It was, therefore, decided to examine the process at two stages, viz.: at the works of a manufacturer producing the special enamelling frits for this purpose and subsequently at a factory where this enamelling frit is used on aluminium, respectively Ferro Enamels Ltd., of Wolverhampton, and Matthew Swain Ltd., of Manchester.

Part of the frit production control laboratory

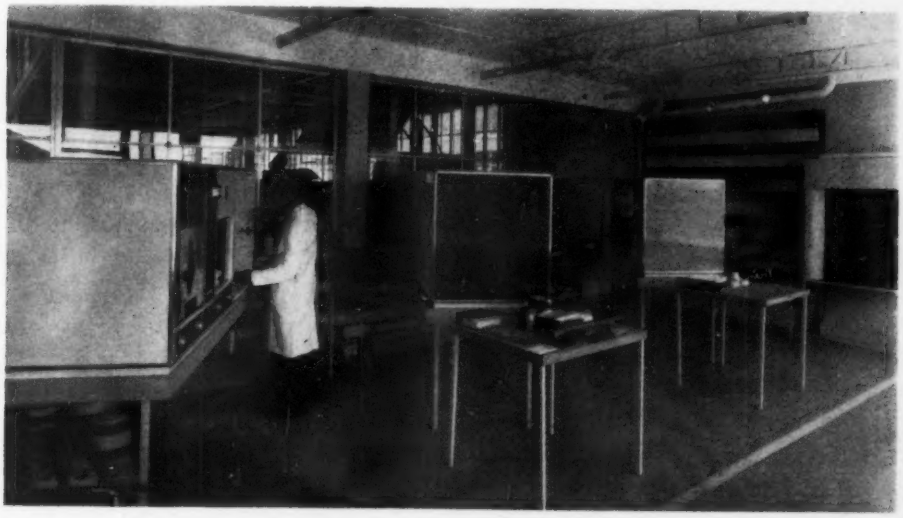
Frit for Enamelling Aluminium

Production at Ferro Enamels Ltd. follows two main lines, batch and continuous. In the case of batch production, the raw materials (after testing, weighing and mixing) are delivered in batches from overhead rail cars into the furnaces below, from which the molten glass is in due course tapped and directed into cold water, where it shatters into fine crystalline particles giving rise to the name frit. This frit is centrifugally dried and, after various testing operations, is ready for milling. There is a slight difference of process for the frits produced on the continuous line. As the molten glass leaves the continuous furnace it falls into chilled rolls immediately below. These are rotating so that a rolled hot ribbon is delivered beneath, where it is cooled by blown air and crushed to flakes which undergo intensive shuffle conveyor cooling before bagging up.

Quality Control

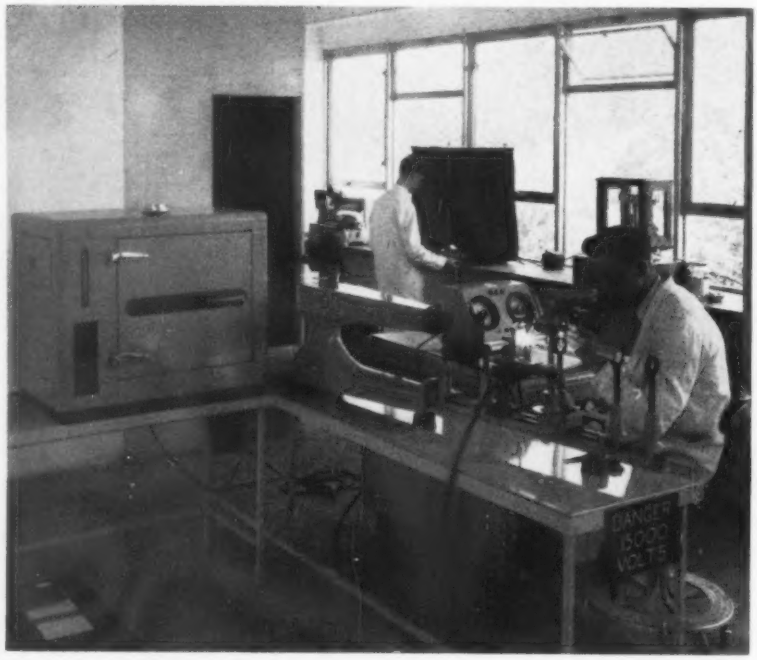
From the point of view of the user, however, the technical control is perhaps as important an aspect as any. This is exerted through two laboratories, one for research and one for quality control of the product during processing.

Typical of the investigations carried out in the research laboratory are photomicrographs up to 2,500 magnification provided by a Zeiss Ultraphot II, and researches into the structure of fired enamels on finished components as well as their resistance properties. Thermal expansion of enamels is investigated on a converted dilatometer, the micrometer head of which has been replaced by a small mirror on which is focused a beam of



Some of the equipment in the colour control laboratory

light, so that as the test piece expands by heating in an enclosed chamber, the mirror is rotated and a light image moves along a scale. Tests are also carried out to find the effect of alkalis and detergents on different enamels, sample enamel plates being boiled in different solutions. Other tests include the effect of condensing steam on the enamel, and further tests are of the drip variety to simulate a domestic tap dripping water on an enamel bath. Colour is tested on a Gardner automatic colour difference meter. In the chemical laboratory a Hilger medium quartz spectrograph is used for the quality control of raw materials. Further analytical control is carried out with a Unicam S.P.900 flame spectrophotometer, with which 30 to 40 elements can be determined with a high degree of accuracy in a matter of minutes. Wet chemical analysis is used for non-routine work.



Hilger medium quartz spectrograph in the quality control laboratory

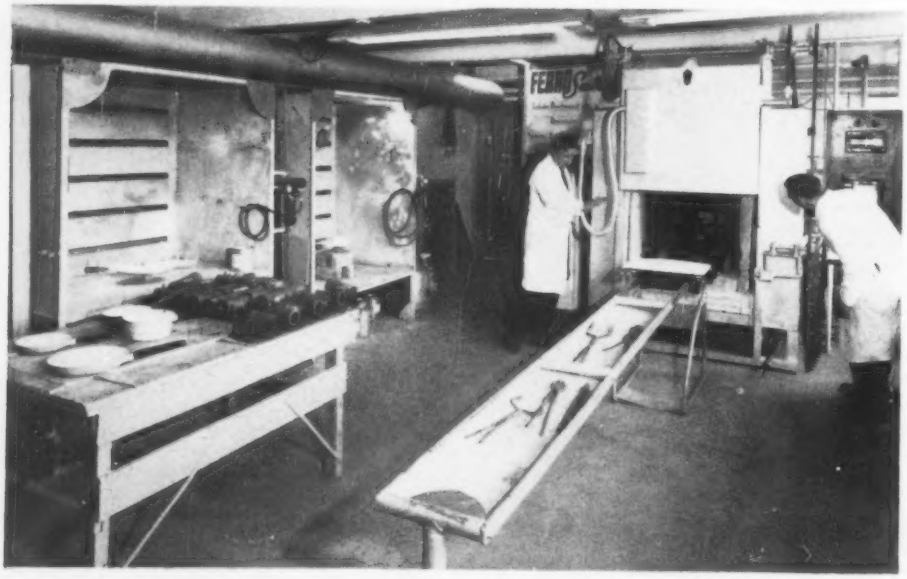
Process Control

The process control laboratory is operated in a somewhat different way. A sample is taken from each production batch of frit and this is milled in a ball mill for two to three hours. It is then sprayed on a plate, and fired in a muffle for the correct time and temperature. An acid test is carried out on the resultant specimen, using 10 per cent citric acid. This is followed by a destruction test carried out by allowing a 1 lb. weight to fall 3 ft. so as to strike a ball placed on the test piece. A fusion test is also carried out by placing a heap of the new milled enamel alongside a standard specimen and heating to see whether they melt at the specified temperature. A number of different types of flow tests are used. Typical of these is the arrangement by which a standard volume of molten enamel is inverted on to a horizontal plate, which is then turned into a vertical position so that the distance the material flows may be measured.

Enamelling Aluminium

It was foreseen at Ferro Enamels that special frits would be required for enamelling aluminium, which is easily understandable since the firing of enamels on aluminium has to be carried out at a lower temperature on account of the aluminium softening at lower temperatures than steel. These special frits have, therefore, to fire at 560°C. instead of the usual 800°-860°C. on steel or 750°C. on cast iron. Some of the frits originally formulated for aluminium contained lead, but it was decided this was undesirable and Ferro Enamels have kept strictly to lead-free enamels. The resultant frit does, therefore, consist of the usual type of glass with additional elements enabling it to be fired at lower temperatures.

For steels there would be two types



General view of the customer service laboratory

of enamel providing, respectively, a dark ground coat and a white or coloured finishing coat. But with aluminium the finishing colour can be put direct on to the parent metal, so that one coat is sufficient.

The frits developed are extremely resistant to impact but probably not quite as good against chemical attack and abrasion as enamels used with steels, on account of the lower firing temperature. A complete colour range has been established for use on aluminium, including white, blues, greens and yellows. The finishes may be gloss, matte or semi-matte. Adhesion has been found to be extremely good between these frits and aluminium, since the latter can be bent with the enamel remaining intact; so much so is this the case that aluminium flexible foils have been developed with an enamelled coating.

It would seem that the enamelling preparation has to produce an oxide on the aluminium which reacts with the enamel to form a bond.

A typical process developed at Ferro Enamels employs the following sequence of operations for enamelling aluminium :—

(1) Clean metal : either by 10 per cent caustic soda (used hot or cold), which etches the aluminium, or by sulphuric acid.
(2) Rinse.
(3) Immerse in nitric acid.
(4) Rinse.
(5) Dry by blown air to remove the droplets.
(6) Pre-fire : at 560° C. for 5-10 min., dependent on weight, one of the associated objectives being the creation of an oxide layer.
(7) Spray the vitreous enamel slip on to the aluminium, using a fine nozzle gun.
(8) Fire : at 560° C. for 5-10 min., depending on size and weight of work and characteristics of furnace; electric convection furnaces have, by experience, been found to be the best.
(9) Cool : at room temperature.

With steel it is necessary to dry the sprayed component before firing, but it is an advantage if aluminium is not completely dry for this operation.

Research in the U.S.A. had established that the best results are obtained when aluminium alloy 6061 (B.S.1470 HS.20) is used. With aluminium enamelled as indicated above, using frits controlled in the way described, the applications have been found to be wide, such as, for instance, architectural panels and tiles, kitchen ware and hardware, lighting reflectors, aluminium castings (if the right alloy), ornamental trays, and so on. A patented process is in operation on the vitreous enamelling of aluminium foil.

Men and Metals

In the New Year Honours List, published during last week-end, the following names were included:—

BARON. — **Sir Alexander Fleck,** chairman, Advisory Council on Research and Development, Ministry of Power, and of the Nuclear Safety Advisory Committee; former chairman, Imperial Chemical Industries Limited.

C.M.G.—**Mr. J. C. Bennett,** joint managing director, Henry Gardner and Company Limited.

C.B.E.—**Mr. G. C. I. Gardiner,** technical director, de Havilland Aircraft Company Limited; **Mr. J. R. Pheazey,** vice-chairman and joint general manager, Standard Telephones and Cables Limited; **Mr. A. A. Rubbra,** technical director, Rolls-Royce Limited; **Mr. E. J. Vaughan,** deputy chief scientific officer, Admiralty; and **Mr. H. Woods,** H.M. deputy chief inspector of factories, Ministry of Labour.

O.B.E. — **Mr. E. G. V. Newman,** principal scientific officer, Royal Mint.

M.B.E.—**Miss J. Brenner,** secretary to director, British Cast Iron Research Association; **Mr. C. H. Meigh,** managing director, Meigh Castings Limited; **Mr. W. L. Roe,** chief metallurgist, Aiton and Company Limited; and **Mr. A. J. Taylor,** experimental works manager, Dowty Rotol Limited.

B.E.M.—**Mr. C. W. Clarke,** foundry apprentice instructor, Marshall Sons and Company Limited; and **Mr. J. R. Griffiths,** No. 1 inspector, Aluminium Corporation Limited, Dolgarrog.

Assuming the position of general manager as from January 1, **Mr. L. C. W. Turner** is joining the board of Thomas Bolton and Sons. **Mr. W. F. Slater** relinquished his appointment as general manager on December 31, but will continue as a director with special duties.

It is understood that the **Hon. R. M. P. Preston** has retired from the board of the Amalgamated Metal Corporation but will remain a director of its subsidiary, the British Metal Corporation. It is also reported that **Mr. A. J. Hugh Smith** has resigned from the board of the British Metal Corporation.

Whilst retaining his present position as managing director, **Mr. P. W. Seligman** has been appointed deputy chairman of A.P.V. Company Limited. **Mr. H. P. N. Benson** has also been appointed a managing director.

Following the acquisition by Leeds and Northrup Company, Philadelphia, of the entire share capital of Integra Leeds and Northrup, the board now consists of **Mr. I. Melville Stein** (President of the parent company) chairman, and **Mr. J. J. A. Rogister** and **Mr. J. W. Robinson** (President of Leeds and Northrup, Canada, Ltd., and vice-president of the parent company) managing directors. **Mr. Maurice Bouffart,** of S.A. Integra of Belgium, resigned from the board on the company becoming the wholly-owned subsidiary of the American firm. Mr. J. J. A. Rogister and Mr. J. W. Robinson will serve as joint managing directors and **Mr. G. G. Ebremare** will continue as secretary.

Succeeding **Mr. J. M. Henderson,** who retired on December 31, **Mr. St. John de Holt Elstub** has been elected chairman of Amal, a subsidiary of Imperial Chemical Industries.

Succeeding **Viscount Weir,** who is giving up his position on the board of the subsidiary to devote more time to the overall administration of the group, **Mr. J. Russell Lang** has been appointed chairman of G. and J. Weir, the principal subsidiary of G. and J. Weir Holdings. Lord Weir is also resigning from the boards of Weir-Catton and Weir Foundries. **Mr. J. W. Atwell** has been appointed managing director of G. and J. Weir in place of Mr. Lang, and **Mr. W. K. J. Weir** becomes an additional director of that company. These changes are effective from December 31.

Previously managing director of Bound Brook Bearings Ltd., Lichfield, **Mr. B. P. R. Parsons** has been appointed chairman of the company. At the same time he has been made a director of the parent company, Birfield Ltd. The previous chairman of Bound Brook, **Mr. H. E. Hill,** who is also chairman of Birfield Ltd., will remain as vice-chairman. At the same time as these appointments, **Mr. T. L. Martin,** formerly administration director, becomes director and joint manager (commercial), and **Mr. W. Harris,** previously works director, is appointed director and joint general manager (works).

Formerly manager of the turbine factory at the Rugby works of Associated Electrical Industries Ltd., **Mr. J. D. Riddle** has been appointed manager of the new large machine and compressor department, and **Mr. R. Evans,** formerly superintendent of large machine production in the heavy plant factory, has been appointed assistant manager.

Appointed as joint managing director of the Star Aluminium Co., of Wolverhampton and Bridgnorth, **Mr. Harry M. Hurst** will serve with **Mr. Frank A. Hurst,** chairman. Deputy to the joint managing directors is **Mr. W. K. Altwegg,** special director and manager,

Mr. R. Lewis Stubbs

Mr. J. C. Colquhoun

also in charge of sales. Two new special directors are **Mr. V. Koller,** in charge of the Bridgnorth factory, technical manager and deputy factories manager, and **Mr. L. Evans,** in charge of the activities of the Wolverhampton factories and production manager.

Director of the Zinc Development Association, **Mr. R. Lewis Stubbs** has been appointed director-general of the Lead Development Association and the Zinc Development Association. Mr. Stubbs will be responsible for the overall direction and expansion of the work of both organizations, and will represent them at international meetings. Each Association will continue to function separately, and general managers will be appointed for both in the New Year.

As from January 1, **Mr. C. H. Morris,** managing director of Wadkin Ltd., retires but retains his seat on the board as vice-chairman. **Mr. S. Radcliffe** and **Mr. W. L. Simms** become joint managing directors. **Mr. W. J. O. Howe** and **Mr. Philip H. Morris** have been appointed directors.

Joining the board of The Mint, Birmingham, is **Mr. J. J. Gracie,** whose appointment dates from January 1. **Mr. O. A. Pallet** resigns from the board for health reasons.

A new director, **Mr. R. H. C. Boys,** has been appointed to the board of Metal Traders.

Three new appointments have been made by Lansing Bagnall Ltd., manufacturers of materials handling equipment. **Mr. Alan Potter** has been appointed general sales manager, **Mr. Edgar H. Wheeler** has been appointed export sales manager, and **Mr. Charles A. Barr** has been appointed manager of the company's technical services division.

At the last meeting of the Institute of Physics and the Physical Society, the following were elected Fellows of the Institute: **Mr. C. S. Brown, Mr. L. Bovey, Mr. J. C. E. Button, Mr. C. G. Campbell, Mr. P. M. Cook, Mr. H. J. Goldsmid, Mr. C. Hilsum, Mr. K. Lonsdale, Mr. C. B. McNeill, Mr. G. Power,** and **Mr. C. Weaver.** Forty-six Associates were also elected.

A special director of Vickers-Armstrongs (Aircraft) Limited, **Mr. J. Ferguson Smith** has been appointed deputy general manager. **Mr. J. A. Pull,** engineering manager, has been appointed a special director.

Newly appointed to the board of Headland Gauges Limited are **Mr. J. H. Thornton** and **Mr. P. H. van Klaveren.**

Past President of the Royal Society and Nobel Laureate for Chemistry, **Sir Cyril Hinshelwood** has been awarded the Society of Chemical Industry's Medal for 1961. He will receive the medal at the annual meeting of the society, to be held in Oxford in July this year.

Deputy-chairman of the Metal Box and of the overseas company since August 1959, **Sir Harold Roxbee Cox** has accepted the position of chairman of both these companies. Owing to these new responsibilities, it is understood that Sir Harold is reducing his other commitments and has resigned from the board of Wilmot-Breeden (Holdings).

News from Manganese Bronze and Brass Company is that **Mr. J. C. Budd** has been appointed chairman of the company in succession to **Mr. J. C. Colquhoun,** M.B.E., who has retired, having served as chairman since 1932. **Mr. R. Dennis Poore** has also been appointed a director of the company.

It is reported that **Vice-Admiral Sir Norman Dalton** is to take up an appointment as technical consultant to J. Stone and Company (Holdings) and has joined the board of Epsylon Industries. Both these companies are members of the Stone-Platt Industries group.

News from the British Oxygen Company is that **Mr. B. R. D. Clarke** has been appointed administration officer of the technical division of the company, and that **Mr. E. F. Burgess** has been appointed secretary of the company.

Appointments announced by Thos. Firth and John Brown Limited include those of **Mr. A. Broomhead** as deputy managing director, and **Mr. F. Wortley,** a director, who has been appointed general works manager.

A tour of Middle East countries is to be undertaken this month by **Mr. J. C. G. Mead,** assistant managing director of The Delta Metal Company Limited, who will visit Bahrain, Qatar, Kuwait, Iraq and Iran. He will be accompanied by **Mr. D. J. W. Dolton,** personal assistant to the managing director.

An announcement from the Lead Development Association states that **Mr. D. W. Payn,** T.D., F.C.C.S., has resigned as general manager and secretary to the association in order to take up an appointment with the London Master Builders' Association.

It has been announced by Enfield Cables Limited that **Mr. B. Powell** has been appointed chairman in place of the **Earl of Verulam,** who has resigned from the board. Lord Verulam remains chairman of the parent company, Enfield Rolling Mills Limited, and **Mr. D. J. Hastings** has been appointed a director of Enfield Cables.

News from the same group also states that **Mr. W. W. Kee** has been appointed an additional director of Enfield Rolling Mills Limited, and that **Mr. R. J. Smith** has been appointed secretary of that company.

Appointed manager of the Fisher Governor Company, a member of the Elliott-Automation group, is **Mr. N. R. Dent.**

Radiation Pyrometer

A RADIATION pyrometer and associated electrical circuits capable of continuously measuring surface temperatures of metal bars in the range 650° C. to 750° C., travelling at rates up to 20 ft/min., are being patented by the U.K.A.E.A., according to *Atom.* Measurement is effected in a narrow band ($\frac{1}{2}$ in. to $\frac{1}{4}$ in.) between a heating zone and a quenching zone.

A heat radiation transmission path is provided by a fused quartz rod, the receiving end of which is shaped like a fish tail and partly encircles the bars. At its other end is a lead sulphide photocell.

The quartz rod has two breaks, the first for a rotary radiation chopper in the form of a slotted disc turning at a speed to give a chopping frequency of 1,000 counts/sec., the second for a radiation chopper having alternate blades of perspex and germanium and giving a 10 c/s frequency.

Furthermore, the rod transmits radiation over the wavelength interval from 0 to 2·5 microns, the perspex blades of the second radiation chopper from 0 to 2 microns and its germanium blades from 2 to 2·5 microns.

Thus, the lead sulphide cell receives alternate signals at 10 c/s on a 1,000 c/s carrier signal.

The current from the cell is amplified and rectified and the two D.C. levels corresponding to the two wavelength intervals fed to a switch. The resulting signals are smoothed and transmitted to the slide wire and pointer of a potentiometer and presented to the ratio recorder of this device.

The reading at the ratio recorder is a function only of the bar surface temperature.

REVIEW OF THE YEAR'S ACTIVITIES IN PRIMARY METALS

Base Metal Markets

BY OUR METAL EXCHANGE CORRESPONDENT

THE year just closed was in many respects a troubled one, not only for business and commerce as a whole, but also for non-ferrous metals in particular. Unrest in the copper producing areas has become commonplace since the end of the war, and 1960 had its share of strikes, which interfered to a considerable extent with output. Nevertheless, in this respect matters were a good deal better than 1959, when the prolonged dispute in the United States robbed the world of many thousands of tons of copper. The American steel strike was settled in the early days of January, but halfway through the month a report of political disturbances at Elizabethville foreshadowed the Congo cataclysm.

In March there was again news of trouble in the Congo, and a 24 hours "warning" strike at Chilean copper plants suggested that once again we should suffer from a stoppage in one of the producing areas. In due course, this fear was fulfilled, for Chuquicamata was strike-bound for six weeks from October 1. Throughout most of March there was acute racial trouble in South Africa. April was a disturbed month, with a wildcat strike at Mufulira and a rejection by Chilean mineworkers of a wage offer by Anaconda, a step which led to a month-long strike during May at the El Salvador property. Nothing came of a threat of a general Chilean strike, but a week before the El Salvador strike was settled, Chuquicamata and El Teniente threated to come out.

Turning to events nearer home, it was announced in May that the new lead zinc contracts would operate on the Metal Exchange from October 1. This was the final event in a prolonged and, perhaps, even slightly acrimonious, discussion about revising the basis of operation in these two metals on the Exchange. The point at issue was whether trading in zinc and lead should fall into line with copper and tin in being based on an "in warehouse" contract, or whether "ex ship" should continue to be the method employed. Broadly, the producing interests supported the existing plan, while consumers and merchants favoured a change. Finally, at a full meeting of members of the Exchange, the matter was put to the vote and, by a fairly narrow majority, it was decided that the two metals should, from January 3, be traded on a warehouse basis. One other domestic item may perhaps be mentioned, and that is the fact that on May 23 a contango appeared in tin for the first time for six months.

Tin was also in the news in June, for at the end of the month a three year price peak was reached at £800, this achievement following an announcement that under a new Tin Agreement the Buffer Stock would be cut by 5,000 tons to 20,000 tons. A week-long dock strike at Liverpool disrupted traffic through the port this month, and both incoming and outgoing cargoes of copper were affected. On June 23 the Bank Rate was raised to 6 per cent.

For some time it had been evident that stocks of copper were building up as a result of over-production, and on June 2 it was announced that the Anglo-American Corporation might cut their output of copper during the second half of the year by about 10 per cent. An interesting feature of this plan was that the reduction would probably be achieved partly by an actual reduction of the tonnage mined and partly by withholding copper from the market.

In July, it was reported that the Katanga mines had closed down, and it was known, moreover, that Katanga province had declared its independence. This was certainly bad news for users of copper in Europe, and the market in London forged ahead in no uncertain manner. Fortunately, the acute alarm about Katanga was short lived, for within a week or so it was reported that matters were back to normal, but right through the second half of the year the state of affairs in the Congo has been such that the market has been kept on tenterhooks. There was a message from Chile to the effect that Chuquicamata workers would ask for a 70 per cent increase at the end of September.

August ushered in a wages claim by the Copperbelt workers and it was uncertain throughout the month what would happen, but, fortunately, an agreement was reached. With the Katanga outlook continuing to improve, and a report that Continental consumers were re-selling copper, tension largely went out of the market, and on the midday market on August 15 a contango appeared. Stocks in Metal Exchange warehouses were rising steadily and seemed to be heading for the 10,000 tons mark. In September, the Chilean trouble began to loom large and there was also further talk of the Rhodesian producers cutting output. This, in fact, was confirmed on October 3, when it was announced that production would be reduced by 10 per cent during the second half of the year. The figure envisaged was at the rate of 60,000 tons per annum. The Chuquicamata strike also began on October 3 and lasted till November 14.

One way and another, October was an unsettled month, for there was a prolonged strike of the tally clerks in the Port of London, which was settled half way through the month, and a big rise occurred in the price of gold. Towards the end of the month, Bank Rate was reduced by ½ per cent to 5½ per cent and later in the year, on December 8, to 5 per cent. Throughout the year, a good deal of publicity was given to the question of a fixed price for copper, a scheme much favoured by the producers, but very much out of favour with the consumers in this country and in Germany. It is known that discussions took place between the interested parties, but up to the end of the year nothing had occurred.

The Tin Council continued to meet at set intervals, and in March it was announced that the quota for the second quarter would be fixed at 37,500 tons. Apparently, the increase of 1,500 tons was made because one of the producing countries was not expected to be able to find its full tonnage allocation. In June, exports were pretty well freed, but there was some anxiety as to whether Bolivia would be able to provide the tonnage expected. In November, at a meeting held in Rome, the Tin Council decided to leave tin exports unrestricted for another three months, which, of course, applies to the first quarter of 1961. Demand was not at all good in the United States during the second half of the year and there was, therefore, some idea that the Council might think it necessary to restrict exports again. Presumably, the information open to them supported a decision to refrain from applying any curbs, and it is, of course, true that there have been forecasts about the tin position which suggested that a short fall would be seen against anticipated usage.

Arising partly in connection with the arguments about the possible establishment of a fixed price for copper, the London Metal Exchange was under criticism over its methods of trading. This is now something of a hardy annual, and somehow the critics fail to come forward with concrete suggestions to improve existing methods of dealing. Price movements are reported under the headings of the various metals, and fluctuations were not unduly wide considering background events. Unfortunately, a backwardation ruled in copper during the greater part of the first eight months of the year, giving place to a contango for about three months, after which a backwardation reappeared.

Copper

Among the interesting and somewhat surprising things that happened to the London copper market last year was the decline in stocks held in Metal

Exchange warehouses from an opening figure of 5,372 tons, at the beginning of January, to a low point of 1,674 tons towards the end of April, when the backwardation stood at £25. Thenceforward an improvement set in which carried the total to around 14,000 tons by the end of the year.

The year opened with cash at £253 10s. 0d. and three months £14 cheaper, but growing scarcity, due to the fact that Kennecott's dispute with the union was not settled as had been hoped, forced the prompt quotation up to £273 on January 28. This was the highest cash price for three years, and nearly the highest for 1960, which, however, was seen in April at £279 10s. 0d. These high prices, apparently, did nothing to upset consumption, which was very good throughout the year and probably higher than in 1959. For the moment, £273 proved to be the top, for news that the Kennecott strike was settled, after 171 days, crashed the market to £262 10s. 0d. on January 29.

February opened firm on supply uncertainties, but values fell away to £251, appreciating again to £258 on the last day of the month. A reduction to 33 cents by American custom smelters on March 10 forced the London market down to £244 four days later, but a recovery followed to £259 on March 28. April was a month of wide variation in value, indeed between £250 and £279 10s. 0d. for cash, the cause being unrest and uncertainties in Chile and Rhodesia. At the end of the month, there was a threat that all Chilean properties might strike.

The unrest in April reached breaking point in May, for at the beginning of the month a strike broke out at El Salvador, the Chilean property of Anaconda, and lasted until May 27, following which we saw the low point for the month at £237 10s. 0d., £264 being the high limit. With L.M.E. stocks over 8,000 tons, the backwardation declined at this time to 25s. May also brought a threat of an indefinite strike by Chuquicamata. June started with cash copper at £241, but worked up to £258 10s. 0d. near the end of the month. July was one of the relatively steady months, the range being between £250 and £264 10s. 0d., but the backwardation had widened to £6. August reflected the annual holiday conditions and on the last day of the month cash copper fell to £235, for stocks had risen to 7,000 tons, and a few days later stood at 8,400 tons. The high point for the month was £254 10s. 0d., registered at a time when a Copperbelt wages claim was tabled. This demand, however, was settled at the end of August.

September was relatively featureless, with a low point for cash copper of £230 5s. 0d. at the end of the month, but October opened on a strident note, for the Chuquicamata strike began and the Rhodesian production cut was announced. Moreover, the custom smelters reduced by 2 cents to 31 cents and the producers followed a few days later.

On October 18, a report from Katanga announced a cut in output of 2,500 tons per month, but at the same time it was said that output in 1960 would be about 308,000 tons against 280,403 tons in 1959. At October 31, warehouse stocks were over 10,000 tons, and the cash price fell as low as £218. Mid-November saw the Chuquicamata strike settled, but a technical development on the market created a backwardation. £220 was the low point for cash and £231 5s. 0d. the high. December opened firm, but in mid-month business fell away and an easier tone appeared.

On December 19, three months copper was quoted at £224 following an increase in L.M.E. stocks to 13,555 tons, but bear covering, prompted by renewed fears about the Braden strike, took the cash price up to £231 just before Christmas. The year ended with stocks over 14,000 tons. Cash copper stood at £227 15s. 0d., and three months at £226 5s. 0d., for lack of demand brought a decline during the three days after Christmas.

Tin

The year opened with tin at £786 cash, with three months £3 10s. 0d. lower, but firmness developed and £796 was reached on January 20. Minor fluctuations were seen in February, while in early March the International Tin Council announced an increase to 37,500 tons in the quota for the second quarter. This had little effect on the quotation, which touched £792 during the month, rising as high as £799 in April, when the backwardation widened to £8. May saw a downward trend, and a low point of £781 was registered, but the new Tin Agreement, cutting the Buffer Stock by 5,000 tons to 20,000 tons, rallied the quotation to £813 on July 1. This rise continued, and on July 26 £819 was reached. August brought an easier trend, and a low of £791 10s. 0d. was seen, but this was reversed in September, with a climb up to £818. In October, the range was between £801 and £813, but in November the decline in American buying made itself felt, and the price fell to £796 10s. 0d.

Continued lack of demand, and the knowledge that there would be plenty of metal available in spite of forecasts that production would outstrip consumption on a world basis, brought an easier tone in December, and when the Exchange closed down before Christmas cash tin stood at £791. The year closed at £788 10s. 0d. for prompt and £788 forward.

Lead

The year opened with prompt metal at £74 15s. 0d. and forward £1 cheaper, but ample arrivals depressed the price to £72 in February. March closed at £76 15s. 0d. April saw the quotation as high as £78 5s. 0d. and May 10s. higher. During June, however, a spasm of weakness shook the market and a low point of £70 10s. 0d. was seen, while July brought little or no improvement. Plentiful supplies and some decline in usage, due to the holiday season, saw a fall to £70 in August. In September, all the metals were rather depressed, and once again lead declined on reports of more than ample supplies, even though it appeared that consumption in this country was on a good scale.

In that month, the quotation for the current period fell as low as £68 12s. 6d., while December metal was 7s. 6d. dearer. Although October ended with the price at £68, a low point of £66 5s. 0d. for the current month was recorded due to heavy sales of prompt metal on the market, but it is interesting to note that the three months price did not decline below £68. The new contract began to operate on October 1 so that forward sales were made for a fixed prompt in January. During the first half of November prompt metal rose to £69 17s. 6d., with three months at £70 5s. 0d., but the month closed about £2 10s. 0d. lower.

Later on, however, worse was to come, for in early December a wave of pessimism engulfed the lead market, and on December 20 the prompt price dropped to £63 7s. 6d. following a reduction in the U.S. quotation to 11 cents. After the holidays, prompt lead fell to £62, and the year ended at £62 10s. 0d.

Zinc

Like lead, this metal suffered in 1960 from an overplus of supplies, during the second half of the year mainly, for surplus American zinc was shipped to Europe, and these sales depressed the London market. January ushered in a price of £94 15s. 0d. with a backwardation of £5, and, to a varying extent, this premium for prompt metal persisted during most of the year. By the end of the month, the price was down to £93, but February ended at £87 2s. 6d. March, however, made a much better showing and on the 31st the quotation was £93 15s. 0d., but April saw the price at £90 15s. 0d. although the month ended at £94. At May 31 it was £91 5s. 0d., and in June £92 was the best level achieved.

July saw the beginning of a downward movement due to increasing stocks and overseas selling, and a low point of £88 2s. 6d. was seen. Slack business took the quotation down to £85 12s. 6d. in August, but a recovery soon followed in September to £89 15s. 0d.

In October, the price dropped back at one time to £86 10s. 0d., but recovered, and fluctuations were again seen in the following month. Throughout December the zinc market looked weak, and on resuming after the Christmas holiday break the quotation collapsed to £77 5s. 0d., but on the following day it was 10s. cheaper. The year ended with December quoted at £78 10s. 0d., with three months at £79 7s. 6d.

Industrial News

Home and Overseas

A Big Move

Moving one factory is itself quite a task, but on November 28, the **London Aluminium Company Limited,** of Witton, Birmingham, began to move no less than three factories (their main works in Westwood Road, the nearby factory in Tame Road, and also the one in Oldbury) to their new £500,000 site on the Bridgnorth Road, Wombourn.

Throughout the move, production continued uninterrupted. Moreover, London Aluminium started production from their new factory on January 1, only six weeks after the start of the removal operation. By the end of March, the new factory should be in full production and it is expected that by the end of the year output will be considerably increased.

The new premises comprise a 600 ft. three bay shop, a self contained anodic shop, and an office block. The contemporary L-shaped two-storey office block is equipped with air conditioning plant and large, draught-free windows.

In the three-bay shop, covering 140,000 ft^2, the company are adding six new presses, each with a capacity of over 500 tons, to their already extensive battery of presses. The layout of machinery to be installed in the new factory has been planned in such a way that handling of materials and goods is reduced to a minimum. Where equipment and products have to be moved from one section to another, mechanical means will be utilized.

When full production starts at the new factory, the company will, it is said, be using the first fully-automatic brightening and anodizing plant to be operated in this country. It is installed in a specially built anodizing shop which has been erected at the rear of the main shop. Some of the equipment for the new plant has been manufactured in Birmingham, such as the tanks used in connection with the various processes, but the larger automatic plant has been brought over from America. Some 80 ft. long, 15 ft. high and 11 ft. wide, the complete plant weighs well over 100 tons. With this new plant, London Aluminium will be able to combine the operations of brightening and anodizing into one fully automatic process and thus effect a great saving in time and labour, besides producing much greater uniformity on the finished products.

A recirculatory system has been incorporated with the effluent plant, whereby 75 per cent of the water consumption is treated and returned to the anodic shop for further use. To deal with research and development, which is continually being carried out, a well equipped laboratory has been built and additional control chemists will be employed.

Being fully conscious of the need for good staff welfare arrangements, the company have made provision for a large staff canteen on their site. This will be ready by the end of February and will be able to provide hot meals and snacks for the labour force of approximately 1,000 operators and clerical staff.

Industrial Finishes Convention

At the First International Industrial Finishes Convention in London, which opens on May 8, and runs simultaneously with the First International Industrial Finishes Exhibition, at Earls Court, London, the Papers include: "Paint Finishing Methods and Plant"; "Automatic Polishing"; "Chemical Polishing"; "Recent Advances in Organic Finishes"; "Developments in Aluminium Finishes"; "Water Soluble Resin Finishes"; "Advances in Nickel Plating"; "Chromium Plating to British Standards No. 1224:59"; "High Temperature Paint Curing Techniques"; "The Airless Spray Technique"; "Titanium for Industrial Finishing Processes"; "Problems of Dust in Finishing"; "Vitreous Enamel Developments"; "Aspects of the Coating of Strip"; "Hot Dip Galvanising"; and "Metal and Plastic Coatings". Technical films will also be shown.

The Convention is being organized by Scientific Surveys Ltd., 97 Old Brompton Road, London, S.W.7 (telephone Knightsbridge 9360). The registration fee for delegates is one guinea, or three guineas for those wishing to have printed copies of the Papers.

Films in Science Research

The Department of Scientific and Industrial Research has set up a working party to consider national needs in the field of scientific film. It is especially interested in the aspects of film as a research tool and in communicating research results.

To assist the working party, the Department, in co-operation with the other Research Councils, the Atomic Energy Authority and some Government Departments, is circulating a questionnaire to industry, universities and research organizations.

In this way, it is hoped to reach all those engaged in the serious use of film in this field; who hold stocks of interesting research film or who have developed unusual techniques and applications.

Anyone who can contribute to this enquiry, but who has not received the questionnaire, is invited to contact the Information Division, Department of Scientific and Industrial Research, 14-18 Cornwall Terrace, London, N.W.1.

Versatile Welding Transformers

Equipment which combines arc welding with brazing, hard surfacing and silver soldering, is among the range of "Ferrous" electric arc welding transformers for which **U.S. Industries Inc. (Great Britain) Limited** have been appointed sole distributors in overseas territories, with the exception of certain territories where a non-exclusive arrangement exists.

Additional Group Offices

Having acquired the lease of 7 Cleveland Row, St. James's, London, S.W.1, **The Firth Cleveland Group** is to house there the Home Sales Divisions of Simmonds Aerocessories Limited, Firth Cleveland Instruments Limited and Surform (Firth Cleveland Tools Limited) and Home and Export Sales Departments of British Lead Mills Limited, Seculate Limited and Richard Hill Limited.

Consequential changes of address are as follows: The Home Sales Offices, Water Separator Division, Simmonds Aerocessories Limited; Technical Liaison, Simmonds Aerocessories Limited; Home Sales Offices, Firth Cleveland Instruments Limited; and from January 7, Home Sales Sales Offices; Spire Speed Nut Division, Tools Limited; have all moved to 7 Cleveland Row, St. James's, London, S.W.1. Telephone, Whitehall 3100; telegrams, Fircleve Piccy; telex, 2-2703.

From January 14, 1961, the following will also be at the new address: Home Sales Office, Spire Speed Nut Division, Simmonds Aerocessories Limited; London Area Manager, Industrial Nut Division, Simmonds Aerocessories Limited; Southern Area Manager, Spire Speed Nut Division, Simmonds Aerocessories Limited; Head and Sales Offices, British Lead Mills Limited (telephone, Whitehall 5772 until June 14, 1961); Head and Sales Offices, Seculate Limited; General Sales Office, Richard Hill Limited; London Design Office, Richard Hill Limited.

With effect from January 14, 1961, the London Sales Office, The Firth Company Limited, will be located at Stornoway House, Cleveland Row, London, S.W.1 (telephone, Whitehall 2166; telegrams, Fircleve Piccy; telex 2-2703), which will also continue to house the following group offices: Firth Cleveland Limited, all Departments; Firth Cleveland Pumps Limited, Sales Offices; Simmonds Aerocessories Limited, Export Sales Offices; Firth Cleveland Instruments Limited, Export Sales Offices; Landmaster Limited, Export Sales Offices.

United States Aluminium Industry

Business figures in the American aluminium industry generally during 1960 were below those of 1959, according to a statement issued by Kaiser Aluminum and Chemical Corporation, the principal contributing factors being temporary in nature. Price weaknesses in certain product areas have accompanied the year's severe competition for business. The aluminium industry's own market development efforts have also affected the current earnings picture; prices for certain mill products designed for the mass production industries are necessarily established at levels which will make these products generally competitive with other available materials. This has the effect of reducing profit margins on these products during the development and build-up period. However, as soon as satisfactory volume is attained, such products are expected to yield adequate margins.

Estimates indicate that total industry shipments of aluminium and aluminium products for 1960 are likely to come within 4 to 6 per cent of the 1959 record, a level which would mark 1960 as the second highest volume year in the history of the aluminium industry in the United States. Total shipments should approximate 4·6 to 4·7 billion lb. All figures include both domestic and overseas shipments.

However, a substantial portion of primary production capacity is not in use, due to the very large expansions in aluminium reduction capacity which have been completed recently throughout the industry, and reduced activity in the domestic metalworking industries which, therefore, were slow to draw down their abnormally large inventories remaining from 1959.

Kaiser Aluminum and Chemical Corporation operations, both in the aluminium

and refractories industries, have been further streamlined and re-oriented during the year to achieve greatest current income. An outstanding development of 1960 is the Kaiser Aluminum 50 per cent participation with Consolidated Zinc Corporation Ltd., in the building of a complete new world source of aluminium in Australia and New Zealand. This project, to be completed by 1966, represents one of the largest international developments undertaken by a U.S. aluminium producer and makes available to the Corporation, among other advantages, access to bauxite deposits amounting to over two billion tons.

The outlook for aluminium in 1961 must be said to depend upon the outlook for American business in general, since any substantial increase in activity in our basic industries—in durable goods production and building, for instance—is very quickly reflected in increased aluminium consumption.

Cheaper Degreasing Solvents

Two important industrial solvents—trichloroethylene and perchloroethylene—have been reduced in price as from January 1, 1961. The price of trichloroethylene in the United Kingdom has been reduced by £1 per ton and for perchloroethylene by £5 per ton. These reductions have been made possible by greater output following increased demand. The £1,000,000 extension to the solvents plant operated by the **I.C.I. General Chemicals Division** at Runcorn, Cheshire, is now well advanced, and production is expected to start next summer.

European Lead and Zinc

Total refined pig lead production in the O.E.E.C. countries, including the lead content of antimonial lead, produced by smelters or refineries, totalled 61,243 metric tons in November, as compared with 68,840 metric tons in October.

Total stocks, except stocks of remelted metal in the member countries representing 99 per cent of European production, totalled at the end of November 55,652 metric tons, compared with 59,435 metric tons at the end of October.

Final production figures for refined lead (excluding remelted metal) were given for October as: Austria 1,083; Belgium 7,788; Denmark 770; France 10,336; Germany 16,677; Greece 300 (estimated); Italy 4,759; Netherlands 1,300; Spain 6,910; Sweden 4,800; United Kingdom 7,785; Morocco 4,092; and Tunisia 2,240.

Zinc production in O.E.E.C. countries totalled 72,892 metric tons in November compared with 74,267 metric tons in October. In November, 27,077 metric tons were high grade and special high grade zinc, and 45,815 tons other grades. Stocks of refined zinc at the end of November totalled 44,814 metric tons, compared with 50,714 metric tons at the end of October.

Final production figures by countries for slab zinc in October were as follows (in metric tons): Austria 980 (596), Belgium 21,266 (6,831), France 12,882 (6,783), Germany 15,446 (4,153), Italy 6,902 (4,334), Netherlands 2,900, Norway 4,115 (4,115), Spain 4,400 (2,670), United Kingdom 5,376; O.E.E.C. total 74,267 (29,482). Figures in parentheses represent the amount of high grade and special high grade zinc of 99·5 per cent min. purity.

Record Consumption of Nickel

Estimates for consumption of nickel by the Free World set a new high annual record in 1960, exceeding 500,000,000 lb., an increase of over 15 per cent above that of 1959, according to The International Nickel Company of Canada, Limited.

Increased uses of nickel in Europe was the main contributing factor to the free world's record-breaking consumption during 1960. Differing from the pattern of past years, total consumption in North America was below that of the balance of the Free World.

Total consumption of nickel in the United States and Canada in 1960 will be approximately the same as in 1959.

For the year 1960, the geographical distribution of the Free World's consumption of nickel by areas is estimated as follows: Europe, 43·5 per cent; United States 43 per cent; Canada 2·5 per cent; and others, 11 per cent.

All markets for nickel advanced during the year, with the use of nickel in stainless steels showing the greatest gain at approximately 32 per cent of total nickel used. A substantial increase was also registered for the application of nickel in electroplating, mainly as a result of the use by the automotive industry of improved techniques, permitting higher quality nickel plating. 16 per cent of the total went to this field of use. High nickel alloys and nickel alloy steels consumed 15 and 13 per cent respectively.

Production capacities expanded in 1960, and it is estimated that before the end of 1961 the total nickel production capacity of the free world, exclusive of Cuban sources, will approach 600,000,000 lb. annually. Canada will account for more than three-quarters of the Free World's total nickel production capacity in 1961.

The market price for refined nickel in the United States continued unchanged during 1960 at 74 cents/lb., including the 1½ cents U.S. import duty. The corresponding Canadian currency price reflected prevailing exchange rates, exclusive of the 1½ cents import duty. The price of nickel in the United Kingdom, which is £600 per long ton, remained unchanged, as did the price on the Continent.

An Industrial Tool

Recently developed by **Firth Cleveland Tools Ltd.** is a new industrial tool, the purpose of which is to cut, smooth, shape and trim hard materials—mild steel, aluminium, copper, brass, etc.—and tests on a Herbert file testing machine are said to have indicated that the tool will stand up to long periods of continuous use without impairing its efficiency.

The body of this tool is of all-steel construction. It has a removable forward guide and alternative handles are available. All parts of the tool, except the body, are interchangeable, and will be available separately, i.e. straight handle, cranked handle, blade, forward guide and the necessary screws.

Trade with Greece

It is reported from Athens that the Ministry of Commerce has granted permission for the export of 100 tons of copper and brass slags to West Germany, Belgium, the Netherlands, and Great Britain within three months. Payment will be effected by means of the European Monetary Agreement or by free exchange in the case of their export to Great Britain.

New Electrode Holder

With the idea of providing an electrode holder which will operate continuously without becoming too hot to handle, **Interlas Limited** have introduced a new "Terrier 600" special electrode holder, which is designed in such a way that the handle remains cold under extreme working conditions, using up to $\frac{5}{16}$ in. diameter electrodes at up to 600 amp.

The welding cable is connected direct to the head of the holder, and the operator's hand is protected from any heat in the cable by a deflecting aluminium-painted metal shield, under which the cable is housed in asbestos on its way to the head.

Aluminium in Venezuela

It is reported from New York that a Reynolds Metal Company subsidiary has agreed with Venezuela to form a jointly owned company that will build a reduction plant there with an initial yearly capacity of 25,000 tons of aluminium metal. Mr. J. Louis Reynolds, the chairman of Reynolds International Incorporated, said the plant was expected to cost more than 30 million dollars and would be in the Caroni region of southeastern Venezuela. The pact called for a 30-year supply of hydro-electric power, he added.

The plant will be the first primary aluminium production unit in Venezuela, although Reynolds has fabricating facilities there which will be expanded, Mr. Reynolds said. At first, 80 per cent of the plant's output will be for Venezuelan consumption and 20 per cent for export, he said. The company building the plant will be owned 50-50 by Reynolds and the Venezuelan Government, he added. In September, Reynolds announced it would participate in a 75 million dollar aluminium production project in Greece with private French and Greek interests. Reynolds is to hold a 17 per cent interest in that project and is to have the right to market 35 per cent of the plant's output.

Italian Copper

According to figures released by the Central Statistical Institute in Rome, Italian imports of crude copper for refining in the first nine months of 1960 were 9,575·6 metric tons, valued at 4,200,127,000 lire, of which 60·9 metric tons, valued at 25,016,000 lire, were imported temporarily. The principal suppliers were the Federation of Rhodesia and Nyasaland, with 5,727·5 metric tons, South Africa with 2,326·3 metric tons, and Chile with 975·3 metric tons.

Imports of refined copper in slabs, ingots, plates, etc., totalled 128,131·4 metric tons, valued at 52,564,774,000 lire, of which 14,837·5 metric tons, valued at 6,399,875,000 lire were imported temporarily. The principal sources of supply were: Belgium/Luxembourg 3,748·3 metric tons; France 4,584·6; United Kingdom 8,397·6; ex-Belgian Congo 24,849·9; Rhodesia and Nyasaland 21,437·2; South Africa 7,250·3; Chile 21,395·6; and the United States 30,519·1 metric tons.

Manganese Bronze and Brass

A reorganization to integrate production facilities and co-ordinate sales of two subsidiaries has been undertaken by the £3¾-million **Manganese Bronze and Brass Co. Ltd.** As a result of the reorganization, the two subsidiaries will lose their separate identities and become a division of the parent company, and a central sales office has been established at 10-12 Cork Street, London.

Export sales of ships' propellers will continue to be handled by Stone Manganese Marine Ltd., and the existing "Oilite" and wrought metal sales from

the Ipswich works of The Manganese Bronze and Brass Co. Ltd. will be unaffected.

The two companies who will lose their individual identities are Dean and Son (Yorkshire) Ltd., of Beverley, and Lightalloys Ltd., of Willesden, London, who now go into voluntary liquidation and will emerge as the Deans and Lightalloys Division of The Manganese Bronze and Brass Co. Ltd. At the same time, all production facilities for the new Division will be housed in a large modern foundry in Beverley, Yorkshire. The Lightalloy factory at Willesden will be closed down.

The B.I.R.

Advance notice is given of the Annual General Congress of the **Bureau International de la Récupération,** which is to be held in Rome from May 16 to 18 this year. A meeting of the non-ferrous metal section of the Bureau will be held in the afternoon of May 17. All meetings and the combined luncheons will take place at the Hotel Plaza.

Aluminium Vessels

Now undertaking her first sea voyage is the motor trawler *Captain Foley*, latest addition to the fishing fleet of the Iago Steam Trawler Company Limited, of Fleetwood. Like many modern vessels, this one makes wide use of aluminium—above decks for deck-pounds, wheelhouse, bridge, funnel and other parts of the superstructure, below decks for fitting out the fishrooms.

This is not the first time that the company has made use of aluminium for their vessels, and it was shortly after the war that **I.C.I. Metals Division** recommended an aluminium alloy sheet to the company for use in construction work. This metal proved to possess the required characteristics of strength, durability and ease of working, and the Iago company has continued to make use of this material.

Since its earlier introduction, the design of both shelving and pound boards in this aluminium alloy has been modified to reduce weight and price without impairing efficiency, and today **Imperial Aluminium Company Ltd.,** the subsidiary company formed to handle all I.C.I.'s aluminium interests, makes shelf and pound boards to various designs, as well as fishroom stanchions and ancillary sections.

Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses in the week to December 30 rose 159 tons to 9,556 tons, comprising London 4,245, Liverpool 3,571, and Hull 1,750 tons.

Copper stocks rose 240 tons to 14,334, distributed as follows: London 800, Liverpool 10,459, Birmingham 400, Manchester 2,600, and Hull 75 tons.

Russians to Visit Rhodesia

According to news from Salisbury, three senior Russian trade officials are to visit the Rhodesian Federation shortly for talks with the Rhodesian Selection Trust and the Anglo-American Corporation. Company officials state that the visit is being made at the initiative of the Russians. Last year, the Russians bought about 20,000 tons of copper, valued at about £5,000,000, from the Federation. The delegation consists of Mr. A. I. Drobiasko, President of Razno-import, the Sovet Government department which handles all foreign purchases; Mr. J. Elson, managing director of the non-ferrous metal department of Razno-import, and Mr. I. Kotchetkov, an official of the Russian trade delegation in London. The delegation is expected to spend about five days touring mines in the Copperbelt, and two or three days in Salisbury.

Eire Duty on Aluminium

It has been announced in Dublin that the period of suspension of customs duty on aluminium sheet, strip and foil, in excess of 0·02 in. in thickness, has been extended to June 30 next.

German Import Quotas

New proposals for import quotas of metals in 1961 from countries not members of the European Common Market have been issued by the West German Government. These proposals — which still need the approval of Parliament—are as follows:—

For aluminium, the quota is 110,000 tons, for which customs of 5 per cent are to be levied. An equal duty is to be raised on the quota of 10,000 tons from Common Market countries, while 10,000 tons of aluminium waste are to be brought in free of duty.

Duty-free quotas are to be installed for 16,000 tons of crude magnesium, 50,000 tons of crude lead, and 70,000 tons of crude and hard tin. The duty-free quota of iron sicilium manganese is to be 26,500 tons.

Melting Furnaces

It is reported by **G.W.B. Furnaces Ltd.** that they have now received orders to build four giant electric arc melting furnaces as part of Steel, Peech and Tozer's £10,000,000 development programme. The total order is said to be the largest of its kind in the world. A year ago G.W.B. were awarded a contract from Steel, Peech and Tozer to build two of these electric arc melting furnaces. The company has now received an extension to this order.

The steel construction will be carried out by The United Steel Companies' own subsidiary company, Distington Engineering Co. Ltd. Total output of the finished plant will be 1,135,000 ingot tons of steel a year. The electrical demand of the four furnaces will be equivalent to that of a town the size of Wolverhampton. Each has a rating of 40,000 kVA.

The furnaces are entirely British built and engineered, the basic mechanical design being that of Demag-Elektrometallurgie. They have a nominal capacity of 150 tons, but they will be worked with a 110 ton charge in order to have a shallow bath, with a large surface area; this technique is considered by some metallurgists as a better way of making steel, rather than having a deep bath and smaller surface area for a given tonnage.

Spark Erosion Machines

Spark erosion is a process used in connection with the machining of "difficult" alloys. The function of spark erosion is to vaporize the metal by a high frequency discharge, each spark vaporizing a fragment of metal while it is immersed in a dielectric, usually paraffin or transformer oil. The performance of the machine depends upon the absolute cleanliness of the dielectric liquid, and in this connection **Stream-Line Filters Ltd.** have been working in close liaison with the manufacturers and their latest filter design is a unit which ensures the complete removal of all the eroded particles. This new filtration unit incorporates a Stream-Line filter embodying the principle of their well-known edge filtration.

The construction of the unit is arranged so that filtration can be either continuous or in batches, according to requirement. For continuous filtration, the unit is coupled directly into the spark erosion oil line in a closed circuit and the dirty liquid flows into the filter, where it is cleaned and returned to the machine. For batch filtration, there are two 20-gal. tanks, the dirty one in the front and the clean one at the back, each with a separate motor driven pump. The liquid in the dirty tank passes through the filter and flows into the clean tank ready for transferring to the spark erosion machine. Valves and cocks in the piping circuit make it easy for the required filtration system to be brought into operation. A suitable metal drawer is situated at the base of the filter to catch the sludge when the filter is cleaned by blowing compressed air through the packs in the reverse direction.

Tin Shipments

Tin shipments from Penang in December, according to the Straits Trading Company, amounted to 7,739½ tons, comprising: to United Kingdom 381, U.K. options nil, United States 1,564½, Continent 3,799½, Canada 30, Japan 1,166¾, Pacific 54½, India 294¾, South America 290¼, Africa 25, Australasia 85, and Middle East 47¾. Total shipments from Penang in November were 7,370¾ tons.

Forthcoming Meetings

January 9—Institute of British Foundrymen. Sheffield Branch. Technical College, Pond Street, Sheffield. "Pattern Equipment for Shell Moulding." E. C. Rowen. 7 p.m.

January 9 — Institution of Production Engineers. Sheffield Graduate Section. B.I.S.R.A. Lecture Theatre, Hoyle Street, Sheffield. "Grinding Wheels and Their Application." C. Perrett. 6.30 p.m.

January 10—Institute of British Foundrymen. Slough Section. Lecture Theatre, High Duty Alloys Ltd., Slough. "Coremaking—Modern Methods and Machinery." F. Fallows, J. Harvey and R. Sutcliffe. 7.30 p.m.

January 10 — Institution of Works Managers. Birmingham Branch. College of Technology, Birmingham. "Ethical Behaviour in Industry and Commerce." Canon Bryan Green. 7 p.m.

January 11—Institute of Metal Finishing. Organic Finishing Group, 80 Fetter Lane, London, E.C.4. "Polyurethane Finishes and Foams." H. J. Shearing. 6.30 p.m.

January 11 — Manchester Metallurgical Society. Manchester Literary and Philosophical Society, George Street, Manchester. "Modern Methods of Metallurgical Analysis." K. M. Bills. 6.30 p.m.

January 12—East Midlands Metallurgical Society. Derby and District College of Art, Derby. "The Metallurgy of Semi-Conductors." J. G. Wilkes. 7.30 p.m.

January 12 — Institution of Plant Engineers. North-East Branch. Roadway House, Oxford Street, Newcastle-upon-Tyne. "Fire Prevention in Factories." Fire Prevention Officer, Newcastle and Gateshead Joint Fire Service, 7 p.m.

Metal Market News

ONE might be forgiven for supposing that the bulls of non-ferrous metals would have been well enough pleased if trading in futures for this year had come to an end on December 23 when the Exchange closed down for the Christmas holiday. Without exception all four metals lost ground following the reopening on Wednesday, December 28. Zinc, for example, fell to the lowest point for 18 months and the price of lead had not been matched for 14 years. While business with consumers was not at a standstill, there was not a lot going on, and it will probably be a week or two before normal activity is resumed. On the market, the turnovers in the various metals were not unnaturally below average in view of the three-day week. Dealing in copper was overshadowed by the doubts and fears regarding the prospects of a strike at El Teniente, but since opinion was fairly evenly divided, the lack of demand for the metal weighted the scales downwards. One of the most active metals in the shortened week's dealings was lead, and the quotation registered a new low level of £62 last Thursday. In many directions it is felt that the price of this metal must now be below the cost of production, but the question is complicated by the fact that, to a great extent, lead and zinc are mined together. Nevertheless, there does not seem to be any serious inclination to build up a long position in these metals in the expectation of a profit later on.

Dealing in standard copper was reasonably active, the turnover amounting to 6,725 tons, without business on the Kerb. At the close of business, the backwardation had narrowed from £2 10s. 0d. to 30s., for the final quotations on Friday afternoon were £227 15s. 0d. cash and £226 5s. 0d. three months, these prices showing losses of £3 5s. 0d. and £2 5s. 0d. respectively. Consumer business was probably not on a big scale, but a certain amount of enquiry was reported. The lowest level for the week was seen on Thursday, when at midday cash stood at £227 10s. 0d. and three months at £225 10s. 0d. As to the future trend of values, opinion is a good deal divided, but on the whole, strike or no strike at El Teniente, there is an inclination to believe that the average price of copper over 1961 will rule at a lower level than in 1960. Stocks of copper in Metal Exchange warehouses continue to rise, and last week were reported to be 539 tons up at 14,094 tons.

On Wednesday last week, zinc fell to the lowest price for some eighteen months, and on the following day a further fall to £76 15s. 0d. December registered the bottom for the week. At the close, prompt was £78 10s. 0d. and three months £79 7s. 6d., a drop of 30s. in prompt and 17s. 6d. forward The turnover was 6,850 tons. Lead was also weak, and at £62 10s. 0d. prompt was down by £1 17s. 6d., while three months declined 22s. 6d. to £64 7s. 6d. Some 8,275 tons changed hands, this turnover being the largest of the four metals. Tin fell away in the face of poor consumer demand, news of short time in the steel industry being a contributory factor. Some 405 tons changed hands during the three days following the reopening. Stocks advanced by 123 tons to 9,407 tons.

Birmingham

The outlook for the New Year in Midland industry is tinged with a good deal of anxiety, having regard to the recession in the motor trade and the numerous industries allied to it. Within the last week, even more employees have been made redundant or put on short time. How long these conditions will last no one can tell, but Major Dibben chairman of the Midland Regional Board for Industry, said just before the holiday that these industries seem likely to reach a critical point in the first two months of the year. He also added that industry as a whole in the Midlands, in common with the rest of the country, faces a pause in the upward trend—but with no indication of anything approaching the beginning of a general recession.

With the exception of a declining demand for steel sheets, the position in the iron and steel industry is healthy. Steelworks making joists and sections are booked as far ahead as six months in some instances. This is due to sustained activity among builders and civil engineers. Imports were heavy in 1960 but it seems likely that the high figures recorded for semi-finished and some finished products in 1960 will not be repeated in 1961. Exports have expanded, and strong efforts are being made to make fresh inroads into overseas markets. A high level is maintained in output of iron castings for the engineering industries.

New York

Following the Christmas close-down, copper futures, after early steadiness, declined on scattered selling in moderate dealings, mostly switching, but held steady again later in the week. Dealers and custom smelters indicated negligible domestic business and some export sales at 28 cents/lb. F.A.S. Producer copper was quiet. Physical copper was quiet and steady. The holiday abroad and year-end considerations were making for quietness.

Spot tin was softer, but the other positions were unchanged. The market was quiet. Traders at mid-week noted fair sales in zinc, mostly for January shipment, at an average price basis, while lead was quiet.

Scrap copper was steady and quiet, becoming softer and declining by ¼ cent per lb. to 23 cents. Offerings were fairly large. Tin was quiet and softer, while lead and zinc were quiet. In late dealings tin was quiet and steady. Lead and zinc scrap were barely steady and quiet. On the silver market, the price continued at 91⅜ cents a fine ounce. The domestic movement was estimated at 125,000 oz. on Wednesday of last week.

In Chicago, figures for the combined volume of shipments of ingot brass and bronze for November were placed at 18,518 tons, according to the Council of the Ingot Brass and Bronze Industry. This compares with 18,948 tons shipped in October, and 22,283 tons shipped in November, 1959.

The platinum market ended the year of 1960 with no change in the quiet pattern which had prevailed for several months. Demand continued slow while supplies were adequate during the week ended December 28. Dealers on the outside market again made offerings at 80 dollars per troy ounce, or even 50 to 75 cents cheaper in some cases. Leading refiners, however, adhered to their officially published offering levels of 82 dollars in bulk and 85 dollars in lesser amounts.

Zurich

As is customary at this time of year, the decline in turnover on the Swiss precious metals market gathered momentum in the week to December 28. Business was dull all along the line, but traders expect a slow revival of demand early in January. Prices of gold, silver and palladium eased during the week under review.

Average prices were as follows on December 28 (in francs per kilo—in brackets, where changed from the previous week): gold 4,960 (4,970), silver 130·50 (132·00), platinum 11,000, palladium 3,200 (3,250), iridium 9,000-10,500, ruthenium 7,000-8,500, rhodium 19,000-20,000, osmium 9,500-12,500.

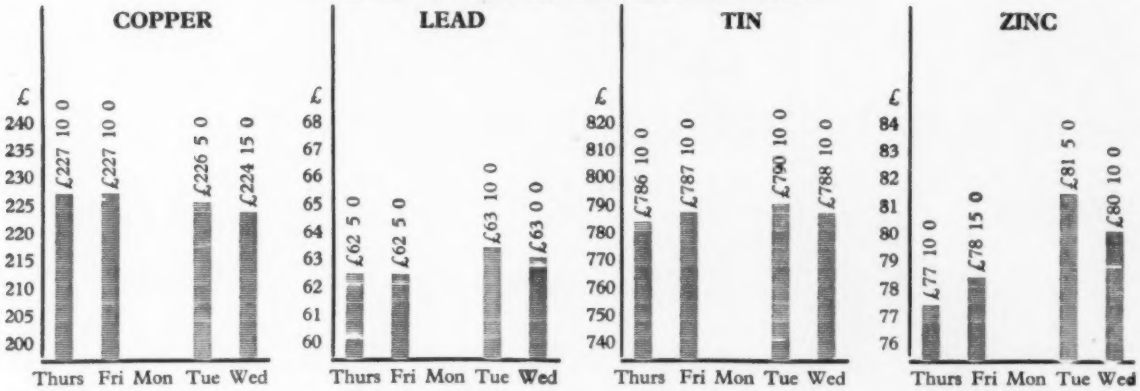
Canada

According to the Dominion Bureau of Statistics, dealers' stocks of non-ferrous scrap metal at the end of September last year included: aluminium group, 3,547,400 lb. (3,290,700 at the beginning of the third quarter); copper group, 9,234,900 (11,955,200); tin-lead group, 6,897,400 (7,244,700); magnesium group, 30,600 (29,600); nickel group, 389,800 (356,200); and zinc group, 3,007,900 (3,043,400).

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 29 December 1960 to Wednesday 4 January 1961



Primary Metals

All prices quoted are those available at 2 p.m. 4/1/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	217	10	0
Antimony Metal 99%	„	210	0	0
Antimony Oxide Commercial	„	193	0	0
Antimony White Oxide	„	196	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	0
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			—	
Copper H.C. Electro	ton	224	15	0
Fire Refined 99·70%	„	223	0	0
Fire Refined 99·50%	„	222	0	0

		£	s.	d.
Copper Sulphate	ton	77	10	0
Germanium	grm.		—	
Gold	oz.	12	13	9
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	63	0	0
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, AZ91X	„	1	11½-2	1½
Manganese Metal	ton		—	
Mercury	flask	69	10	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7⅞
Tellurium Sticks	lb.	2	0	0
Tin	ton	788	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	79	9	4½
Dust 95/97%	„	128	0	0
Dust 98/99%	„	134	0	0
Granulated 99+%	„	104	9	4½
Granulated 99·99+%	„	120	7	6

****Duty and Carriage to customers' works for buyers' account.***

Foreign Quotations

Latest available quotations for non-ferrous meta's with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg≏£/ton		**Canada** c/lb≏£/ton		**France** fr/kg≏£/ton		**Italy** lire/kg≏£/ton		**Switzerland** fr/kg ≏£/ton		**United States** c/lb≏£/ton	
Aluminium			26.00	215 16	2.43	179 11	380	221 10	2.50	206 5	26.00	207 4
Antimony 99.0					2.30	170 0	485	282 15			29.00	231 2
Cadmium					15.75	1,069 0					150.00	1,195 10
Copper												
Crude												
Wire bars 99.9							435	253 12				
Electrolytic	31.75	230 8	28.50	236 11	3.18	235 0			2.80	231 0	30.00	239 2
Lead			10.00	81 0	.94	69 9	163	95 3	.83	68 9	11.00	87 13
Magnesium												
Nickel			70.00	581 0	9.00	665 2	1,200	699 6	7.50	618 15	74.00	589 15
Tin	108.25	791 3			11.08	818 16	1,480	864 6	9.68	798 12	100.75	802 19
Zinc												
Prime western			12.00	99 12 0								
High grade 99.95			12.60	104 11 0								
High grade 99.99			13.00	107 18 0					1.18	97 7		
Thermic					1.20	88 13						
Electrolytic					1.28	94 13	182	108 7			13.50	107 11

C

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 4/1/61

	£	s.	d.
Aluminium Alloy (Virgin)			
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	180	0	0
B.S. 1490 L.M.2 .... „	183	0	0
B.S. 1490 L.M.4 .... „	193	0	0
B.S. 1490 L.M.6 .... „	192	0	0
***Aluminium Bronze**			
BSS 1400 AB.1..... ton	243	0	0
BSS 1400 AB.2..... „	250	0	0

	£	s.	d.
***Brass**			
BSS 1400-B3 65/35 .. ton	174	0	0
BSS 249 ..... „	—		
BSS 1400-B6 85/15 .. „	225	0	0
***Gunmetal**			
R.C.H. 3/4% ton .... „	—		
(85/5/5/5) LG2 ..... „	216	0	0
(86/7/5/2) LG3 ..... „	226	0	0
(88/10/2/1) ..... „	280	0	0
(88/10/2/½) ..... „	250	0	0
***Manganese Bronze**			
BSS 1400 HTB1..... „	195	0	0
BSS 1400 HTB2..... „	214	0	0
BSS 1400 HTB3..... „	231	0	0
Nickel Silver			
Casting Quality 12% „	250	0	0
„ „ 16% „	270	0	0
„ „ 18% „	300	0	0
***Phosphor Bronze**			
B.S. 1400 P.B.1. (A.I.D. releasec) ..... „	306	0	0
B.S. 1400 L.P.B.1..... „	237	0	0

**Average prices for the last week-end.*

	£	s.	d.
Phosphor Copper			
10% ..... ton	261	0	0
15% ..... „	263	0	0
Phosphor Tin			
5% ..... „	—		
Silicon Bronze			
BSS 1400-SB1 ..... „	283	0	0
Solder, soft, BSS 219			
Grade C Tinmans ... „	363	0	0
Grade D Plumbers ... „	290	10	0
Grade M ..... „	399	10	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.	—		
Type 9 „ „	—		
Zinc Alloys			
BSS 1004 Alloy A ... ton	113	17	6
BSS 1004 Alloy B..... „	117	17	6
Sodium-Zinc ..... lb.		2	6½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium			
Sheet 10 S.W.G. lb.		2	10
Sheet 18 S.W.G. „		3	0
Sheet 24 S.W.G. „		3	3
Strip 10 S.W.G. „		2	10
Strip 18 S.W.G. „		2	11
Strip 24 S.W.G. „		3	0½
Circles 22 S.W.G. „		3	4
Circles 18 S.W.G. „		3	3
Circles 12 S.W.G. „		3	2
Plate as rolled ..... „		2	9½
Sections ..... „		3	3½
Wire 10 S.W.G. .... „		3	1
Tubes 1 in. o.d. 16 S.W.G. ..... „		4	3
Aluminium Alloys			
BS1470. HS10W.			
Sheet 10 S.W.G. „		3	2½
Sheet 18 S.W.G. „		3	5
Sheet 24 S.W.G. „		4	0½
Strip 10 S.W.G. „		3	2½
Strip 18 S.W.G. „		3	4
Strip 24 S.W.G. „		4	0
BS1477. HP30M.			
Plate as rolled .... „		3	0½
BS1470. HC15WP.			
Sheet 10 S.W.G. „		4	2
Sheet 18 S.W.G. „		4	7
Sheet 24 S.W.G. „		5	6½
Strip 10 S.W.G. „		4	3
Strip 18 S.W.G. „		4	7
Strip 24 S.W G. „		5	3
BS1477. HPC15WP.			
Plate heat treated.. „		3	8½
BS1475. HG10W.			
Wire 10 S.W.G. „		4	0½
BS1471. HT10WP.			
Tubes 1 in. o.d. 16 S.W.G. ..... „		5	3½
BS1476. HE10WP.			
Sections ..... „		3	3½
Brass			
Tubes ..... „		1	10
Brazed Tubes ..... „		3	0½
Drawn Strip Sections „		3	1½
Sheet ..... ton	197	15	0
Strip..... „	197	15	0
Extruded Bar..... lb.		2	0½
Extruded Bar (Pure Metal Basis)		—	

Brass			
Condenser Plate (Yellow Metal)..... ton	188	0	0
Condenser Plate (Naval Brass) ..... „	200	0	0
Wire ..... lb.		2	8½
Beryllium Copper			
Strip ..... „	1	4	11
Rod ..... „	1	1	6
Wire ..... „	1	4	9
Copper			
Tubes ..... lb.		2	2⅛
Sheet ..... ton	261	5	0
Strip ..... „	261	5	0
Plain Plates ..... „	—		
Locomotive Rods ..... „	—		
H.C. Wire ..... „	278	15	0
Cupro Nickel			
Tubes 70/30 ..... lb.		3	6⅛

Lead			
Pipes (London) ..... ton	104	0	0
Sheet (London) ..... „	101	15	0
Tellurium Lead ..... „	£6 extra		
Nickel Silver			
Sheet and Strip 10% .. lb.		3	10
Wire 10% ..... „		4	3
Phosphor Bronze			
Wire ..... „		4	1⅛
Titanium (1,000 lb. lots)			
Billet 4½" to 18" dia.... lb.	47/-	48/-	
Rod ½" to 4" dia..... „	85/-	53/-	
Wire ·036"-232" dia.... „	159/-	99/-	
Strip ·001" to ·048" .. „	350/-	68/-	
Sheet 8'×2'. 20 gauge „	73/-		
Tube, representative average gauge ..... „	198/-		
Extrusions ..... „	90/-		
Zinc			
Sheet ..... ton	116	10	0
Strip ..... „	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 3/1/61.

	£
Aluminium	
New Cuttings	139
Old Rolled	105
Segregated Turnings	74
Brass	
Cuttings	159
Rod Ends	144
Heavy Yellow	130
Light	125
Rolled	146
Collected Scrap	128
Turnings	137
Copper	
Wire	204
Firebox, cut up	200
Heavy	194
Light	190
Cuttings	207
Turnings	184
Braziery	168

	£
Gunmetal	
Gear Wheels	190
Admiralty.....	190
Commercial	178
Turnings	173
Lead	
Scrap	56
Nickel	
Cuttings	—
Anodes	555
Phosphor Bronze	
Scrap	178
Turnings	173
Zinc	
Remelted	76
Cuttings	66
Old Zinc	43

Financial News

A. E. Griffiths (Smethwick)

Interim dividend 7½ per cent year to March 31, 1961 (same). During first half of year turnover has been maintained at average level of last year's sales, and provided there is no setback, present indications are that group profits for year will be approximately same as those of previous year.

Arthur Lee and Sons

Group net profit, year to September 30, 1960, £810,336 (£432,458), and distribution 13½ per cent (equivalent 8¼ per cent). Fixed assets £2,698,395 (£2,086,973), current assets £6,449,290 (£5,199,461), and liabilities £2,255,504 (£1,666,963). Minority interests £95,821 (nil). Commitments £425,500 (£203,000).

Wright, Bindley and Gell

Group net profit, year to October 1, 1960, £48,257 (£23,766), dividend 15 per cent (equivalent 10 per cent, and special distribution 13½ per cent from investment profit), reported December 7. Fixed assets £354,203 (£341,743), current assets £511,242 (£457,297), and liabilities £234,033 (£272,054), including banker's debt £83,218 (£55,337).

Canadian Nickel

To compensate for recent changes in foreign exchange rates and to keep the domestic price of nickel in accord with the basic export price, the International Nickel Company of Canada Limited announce a change of 2¼ cents per lb. in its price of electrolytically refined nickel for consumption in Canada.

This will increase the price from 70 cents (Canadian currency) to 72¼ cents per lb. from its Port Colborne, Ontario, refinery. The change became effective on January 1 this year. The price change does not alter the company's price of nickel for the United States or any other markets.

Australian Copper

It is reported from Melbourne that the Australian Copper Producers' Association has fixed the price of domestic copper at £A305.

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

Wessex Heat Treatments Limited (676557), 26 Gay Street, Bath. Registered December 1, 1960. Nominal capital, £2,000 in £1 shares. Directors: Robert Jones, Mrs. Edwina P. Jones and Maurice A. Brown.

Associated Refractories Sales Limited (676920), 9 York Street, Sheffield, 1. Registered December 5, 1960. Nominal capital, £100 in £1 shares. Directors: Sidney P. Wagstaff and Cecil B. Pennington.

Sherbourne Metal Products Limited (675905), 46 Hainge Road, Tividale, Tipton, Staffs. Registered December 5, 1960. Nominal capital, £2,000 in £1 shares. Directors: Robert W. Fish and Wm. Fish.

F. and S. (Accessories) Ltd. (677055), 2A Pooles Park, N.4. Registered December 6, 1960. Nominal capital, £100 in £1 shares. To carry on the business of manufacturers of and dealers in scrap metals, motor car accessories, etc. Directors: Edward Flock, George A. Scott and Joseph L. Scott.

Metavic Limited (677296), 5 Hounsfield Road, Sheffield, 3. Registered December 8, 1960. To carry on business of galvanizing, cleaning, pickling and other treatment of metals, etc. Nominal capital, £1,000 in £1 shares. Directors to be appointed by subscribers.

Materials and Methods Ltd. (677357), 24 St. Mary Axe, E.C.3. Registered December 8, 1960. To carry on business of manufacturers and processors of metal and industrial and other materials, etc. Nominal capital, £2,000 in £1 shares. Directors: George Hobman, Philip S. Attenborough, Oliver Smalley, Eric M. Currie and Edward W. Harding.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (new francs per kilo):

Electrolytic copper scrap	(£218.0.0) 2.95
Heavy copper	(£218.0.0) 2.95
No. 1 copper wire	(£211.7.0) 2.86
Brass rod ends	(£158.17.6) 2.15
Zinc castings	(£65.15.0) 0.89
Lead	(£65 0.0) 0.88
Aluminium	(£136.14.0) 1.85

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£189.9.0) 375
Lead, soft, first quality	(£75.18.0) 138
Lead, battery plates	(£44.7.0) 76
Copper, first grade	(£212.15.0) 365
Bronze, commercial gunmetal	(£169.1.0) 290
Brass, heavy	(£142.16.0) 245
Brass, light	(£128.5.0) 220
Brass, bar turnings	(£145.15.0) 250
Old zinc	(£56.12.0) 97

Japan (Yen per metric ton):

Electrolytic copper	(£—)	290,000
Copper wire No. 1	(£—)	272,000
Copper wire No. 2	(£—)	256,000
Heavy copper	(£—)	265,000
Light copper	(£—)	215,000
Brass, new cuttings	(£—)	195,000
Red brass scrap	(£—)	223,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£203.14.0) 235
Heavy copper	(£199.8.0) 230
Light copper	(£173.8.0) 200
Heavy brass	(£125.14.0) 145
Light brass	(£86.14.0) 105
Soft lead scrap	(£52.0.0) 60
Zinc scrap	(£50.4.0) 58
Used aluminium unsorted	(£78.1.0) 90

Trade Publications

Nickel Plating Solution. — W. Canning and Company Ltd., Great Hampton Street, Birmingham, 18.

The latest issue of the Canning News Sheet deals with their nickel plating solution 296 for corrosion resistant deposits. This solution has been specially developed to give a deposit which combines excellent corrosion resistance with maximum levelling. It is stated that this nickel deposit can be used either as an undercoat for Duplex nickel or as a single nickel coating prior to chrome. Extensive corrosion tests have shown, say Canning, that 296 nickel deposits have particularly high resistance to corrosion by industrial atmospheres. Photographs and diagrams are included in the news sheet.

Efco Journal. — Efco Furnaces Limited, Queens Road, Weybridge, Surrey.

The current issue of this magazine contains an interesting article on Isothermal Heat Treatment, accompanied by diagrams and photographs, and another on Heating with Immersed Electrodes.

Welding Products.—Suffolk Iron Foundry (1920) Ltd., Sifbronze Works, Stowmarket, Suffolk.

A new and revised edition of their price list has just been issued by this company and includes two additions to the company's range. Two new rods are listed: Silver Solder No. 38 — in the copper welding and brazing alloy group—has a low melting point of 620°-640°C., and Sifcut No. 40—in the cast iron and hard surfacing alloys section — is a composite rod of tungsten carbide particles in a nickel Sifbronze matrix.

"Built by Davy-United." — Davy and United Engineering Company Ltd., Darnall Works, Sheffield, 9.

This is the title of an excellent book with nearly 100 pages, the main purpose of which is to give an indication of the current range of the rolling mill engineering at Davy-United. Its scope does not extend to full description or individual illustration of all the varied rolling mill plant installed in recent years; it seeks rather to present a visual impression of the design and productive capacity which the company now disposes to meet the requirements of the metal industries. There are many illustrations, quite a number in colours, which add to the attraction and value of this book. Davy and United rolling mills are available for both the ferrous and non-ferrous metals industries.

Copper Rods and Sections. — Imperial Chemical Industries Limited, Metals Division, P.O. Box 216, Birmingham, 6.

A recent publication deals, within 48 pages, with the company's rods and sections in copper and copper alloys. The details cover also brasses for bending and riveting, hot-stamping and free-turning, high-tensile brasses, as well as special alloys, brazing alloys and the like.

I.C.I. Titanium/Corrosion Resistance — Imperial Chemical Industries Limited, Metals Division, P.O. Box 216, Birmingham, 6.

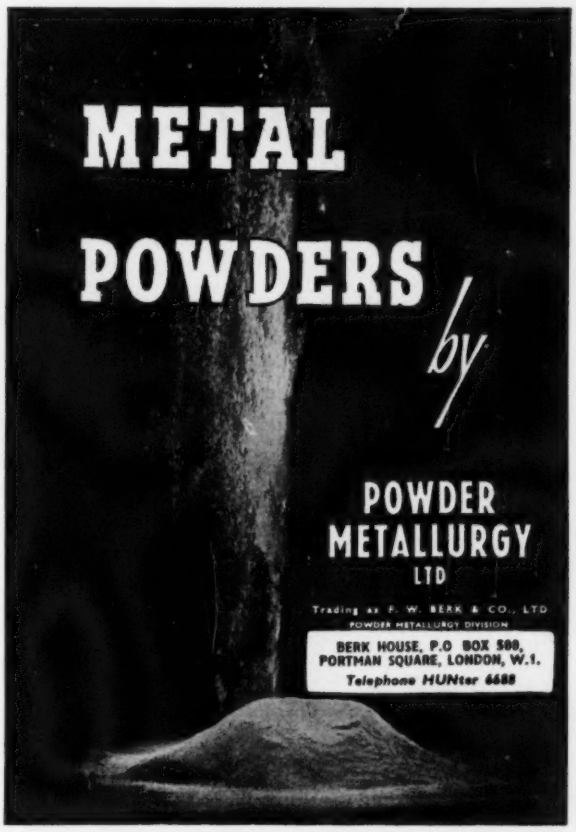
Sixteen pages are devoted to notes indicating the behaviour of titanium in the most commonly used aggressive media. There are also a number of useful tables showing the resistance of titanium to corrosive media.

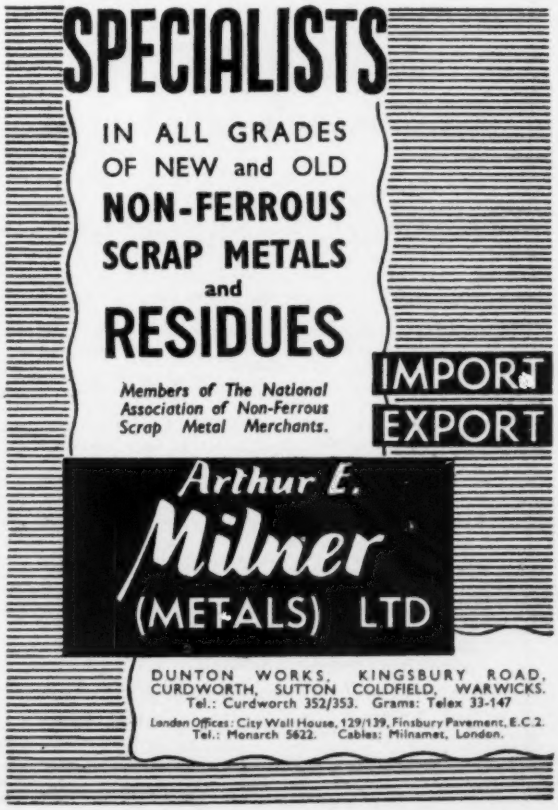
THE STOCK EXCHANGE

Prices Steady, But Business Very Scarce

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 3 JANUARY + RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1960 HIGH	1960 LOW	1959 HIGH	1959 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	26/9 —3d.	11	9	8 4 6	34/9	26/9	33/3	23/3
400,000	2/-	Anti-Attrition Metal	1/3	NIL	4	NIL	1/6	0/9	1/7½	1/-
41,303,829	Stk. (£1)	Associated Electrical Industries ...	40/-	15	15	7 12 0	67/3	39/3	67/-	54/-
3,236,424	1	Birfield	54/- —3d.	15‡	15	2 15 0	61/-	34/0	75/4½	46/-
4,795,000	1	Birmid Industries	71/9 +2/-	20	20D	5 11 6	72/9	56/-	75/6	46/9
5,630,344	Stk. (10/-)	Birmingham Small Arms	36/9 —9d.	17½Q†	12½	4 15 3	45/6	27/7½	69/-	36/-
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/10½	5	5	6 12 3	17/4½	14/10½	17/6	15/-
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/4½	6	6	6 17 3	20/-	17/1½	20/1½	17/9
800,000	1	Bolton (Thos.) & Sons	38/-	10	10	5 5 3	42/3	37/-	47/-	27/6
300,000	1	Ditto Pref. 5%	14/3	5	5	7 0 3	16/-	13/6	16/-	14/9
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	18/3	6	6	6 11 6	21/1½	17/9	21/6	18/9
18,846,647	Stk. (£1)	British Insulated Callender's Cables	49/6 +1/6	13½	13½	5 9 0	61/-	47/6	61/-	45/1½
17,047,166	5/-	British Oxygen Co. Ltd., Ord. ...	26/- +6d.	10	10	1 18 6	34/6	19/6	87/9	49/3
1,200,000	Stk. (5/-)	Canning (W.) & Co.	14/3 +3d.	15+8½C	25+ *2½C:	5 5 3	19/6	13/3	18/1½	12/3
60,484	1/-	Carr (Chas.)	1/-	NIL	12½	—	2/3	1/-	2/10½	1/3
555,000	1	Clifford (Chas.) Ltd.	29/- —9d.	10	10	7 2 9	35/-	28/-	30/-	22/6
45,000	1	Ditto Cum. Pref. 6%	16/-	6	6	7 10 0	16/-	15/9	16/-	17/-
300,000	2/-	Coley Metals	3/9	15	15	8 0 0	5/-	3/3	4/6	2'6
10,185,696	1	Cons. Zinc Corp.†	64/- +3/6	20	15	6 5 0	90/-	60/6	77/3	57/9
5,399,056	1	Davy-Ashmore	129/- —6d.	30‡	20	2 6 6	146/3	100/6	116/-	43/-
7,695,000	5/-	Delta Metal	19/10½	17½	31‡	4 8 0	28/-	18/7½	26/4½	11/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	46/-	15	15	6 11 9	56/3	45/-	61/9	36/7½
1,155,000	1	Evered & Co.	42/9	10B	10φ	3 9 0	42/9	29/-	42/6	30/-
18,000,000	Stk. (£1)	General Electric Co.	29/9 +3d.	10	10	6 14 6	47/6	29/3	50/6	30/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	43/-	20	20	4 13 0	51/6	40/-	47/-	31/4½
750,000	5/-	Glacier Metal Co. Ltd.	15/- +6d.	13	11½	4 6 9	15/9	11/1½	11/3	6/7½
2,500,000	5/-	Glynwed Tubes	25/-	25¶	20	3 14 6	27/1½	17/7½	30/9	16/1½
7,228,065	10/-	Goodlass Wall & Lead Industries ...	34/9	19L	16	4 2 0	41/6	33/4½	53/-	28/7½
342,195	1	Greenwood & Batley	115/-	30	30	5 4 3	133/9	112/6	130/-	75/-
792,000	5/-	Harrison (B'ham) Ord.	12/- +3d.	*20‡	*17½	4 3 0	15/4½	11/9	26/9	14/-
150,000	1	Ditto Cum. Pref. 7%	19/7½xd	7	7	7 2 6	20/-	19/3	19/6	19/4½
1,075,167	5/-	Heenan Group	10/6 +3d.	13D	15	5 8 0P	12/6	10/-	19/6	7/4½
249,932,548	Stk. (£1)	Imperial Chemical Industries	63/9 —2/3	11½N	8	3 10 9	75/3	54/-	62/7½	33/1½
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	15/10½	5	5	6 8 0	17/9	15/6	19/1½	15/6
22,184,044	**	International Nickel	104	$1.60	$1.50	2 16 0	103	85½	201½	154½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/9	5	5	6 15 6	16/6	14/6	17/6	14/9
6,000,000	1	Ditto Ord.	57/9 +6d.	12D	12	2 15 6	66/6	45/-	50/3	27/3
600,000	10/-	Keith, Blackman	17/9	17½	17½E	8 19 6	32/6	17/9	32/-	25/-
320,000	4/-	London Aluminium	8/10½	12	10	5 14 9	12/6	7/6	10/7½	5/3
765,012	1	McKechnie Bros Ord	57/- —6d.	17½F	15F	6 2 9	71/6	57/-	62/6	39/9
1,530,024	1	Ditto A. Ord	55/- —6d.	17½F	15*	6 6 9	69/3	55/-	65/6	38/9
1,108,268	5/-	Manganese Bronze & Brass	13/9	20⅝	20⅝	7 13 0	18/9	13/4½	19/-	13/6
50,628	6/-	Ditto (7½% N.C. Pref.)	6/-	7½	7½	7 10 0	6/6	6/-	7/9	5/9
21,745,110	Stk. (£1)	Metal Box	69/9 +9d.	12M	13B	3 2 6	83/-	55/9	80/-	44/7½
415,760	Stk. (2/-)	Metal Traders	7/6	50	50	13 6 9	10/4½	7/6	13/6	8/4½
160,000	1	Mint (The) Birmingham	37/- —9d.	10	10	5 8 0	39/-	33/6	35/-	22/-
80,000	5	Ditto Pref. 6%	76/3	6	6	7 17 6	80/-	75/-	80/-	69/-
5,187,938	Stk. (£1)	Morgan Crucible A.	54/6	13	12	4 15 6	62/3	47/6	52/6	30/-
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	16/9	5½	5½	6 13 3	18/6	15/9	19/3	17/3
3,850,000	Stk. (£1)	Murex	41/- +2/6	22½J	15	6 5 6	45/-	35/3	76/4½	41/-
585,000	5/-	Ratcliffs (Great Bridge) Ord ...	16/6	10	10R	3 1 6	17/-	14/9	—	
195,000	5/-	Ditto 8% Max. Ord.	5/-	8	—	8 0 0	5/3	5/-	—	
1,064,880	10/-	Sanderson Kayser	34/6 +6d.	35‡	25	5 1 6	40/3	27/7½	56/-	27/9
3,400,500	Stk. (5/-)	Serck	15/9 —3d.	12½	17½GC	3 19 3	25/-	15/7½	26/-	12/-
7,232,069	Stk. (£1)	Stone-Platt Industries	55/- +6d.	15	15	5 9 0	64/3	52/3	63/6	42/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/6	5½	5½	6 17 6	18/7½	15/3	18/9	15/10½
33,989,712	Stk. (£1)	Tube Investments Ord.	74/- +1/3	14	20	4 0 0	95/9	66/3	138/-	71/7½
41,000,000	Stk. (£1)	Vickers	23/9 +3d.	10	10	6 19 3	39/-	27/3	40/6	26/10½
750,000	Stk. (£1)	Ditto Pref 5%	14/-	5	5	7 2 9	17/6	14/-	17/3	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	23/6	*5	*5	7 5 0A	24/3	20/-	25/9	20/6
4,594,418	1	Ward (Thos. W.) Ord.	65/9 +2/3	25‡	20	3 16 0	86/-	64/-	167/6	83/-
7,109,424	Stk. (£1)	Westinghouse Brake	40/6 +1/-	11	10	5 8 9	59/9	37/9	60/7½	39/-
225,000	2/-	Wolverhampton Die-Casting ...	9/- +3d.	35	30	7 15 6	13/10½	8/3	13/1½	8/8½
591,100	5/-	Wolverhampton Metal	24/10½ +10½d.	32½	27½	6 10 9	39/6	23/9	34/3	21/6
156,930	2/6	Wright, Bindley & Gell	3/9	15	20‡	9 13 6	4/3	2/10½	4/3	2/6
124,140	1	Ditto Cum. Pref. 6%	13/3	6	6	8 17 9	15/3	13/3	14/3	12/10½
150,000	1/-	Zinc Alloy Rust Proof	4/4½	40	30	9 2 9	5/6	4/-	3/10½	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. φ and 6½% from Capital Profits. B and 50% capitalized issue. G and 1½d. special distribution. F and special 5% tax free dividend. H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. N Interim since increased. J and 75% capitalized issue. S and 40% capitalized issue. Q calculated at 13⅓%. Interim on smaller capital. P Calculated at 11½%. Q also 1/- special tax free dividend and proposed 50% capitalized issue. T Per £1 unit.





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